Health Policy Research Consortium

THE CLINICAL IMPACT OF DRG-BASED PHYSICIAN

REIMBURSEMENT

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Lisa Iezzoni

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EXECUTIVE SUMMARY

Part B of Medicare is now the fastest growing major federal domestic program and is increasingly dependent upon general revenues to meet its costs. Motivated by these concerns, Congress has asked the administration (Department of Health and Human Services) to consider incorporating physician reimbursement for inpatient care into the prospective payment system (PPS) mandated for hospitals in 1983. The hospital PPS is based upon 470 diagnosis-related groups (DRGs). Under the PPS, hospitals are reimbursed a single amount for each case treated; the payment level is determined by the DRG into which the case is classified. DRG-based single payments for physician inpatient care would represent a radical departure from the traditional fee-for-service system.

The purpose of this report is to evaluate the DRG system as a physician reimbursement tool from the clinical perspective. A number of empirical findings form an important back-drop to this study. The 1982 Medicare data from New Jersey and North Carolina were used to model the performance of the hospital DRG system for physician reimbursement.[1] Several important results lent direction to this clinical analysis:

1. Medical DRGs demonstrate systematically greater physician cost heterogeneity than surgical DRGs;

2. Most of the explanatory power of the DRG methodology in predicitng physician costs resides in the surgical DRGs; and

3. Individual physicians admit small numbers of Medicare patients to the hospital annually.

The first two findings dictated the focus on the medical DRGs.

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1 Janet B. Mitchell et al., Creating DRG-Based Physician Reimbursement Schemes: A Conceptual and Empirical Analysis, HCFA Grant No. 18-P-98387/1-01, October, 1984.

To guide this clinical analysis of the medical DRGs, seven diagnostic areas were examined in depth (see Table 1). The goal of each study was to address the questions: What clinical factors influence physician costs for this diagnosis? Does the DRG methodology adequately capture these factors? The answer to these questions was framed along four clinical parameters as follows:

1. Definitional Precision. How well do the ICD-9-CM codes serve as a proxy for diagnosis? Given the constraints imposed by the ICD code system, how well do the DRGs group together clinically homogeneous entities?

2. Severity of Illness. What impact does differing severity of illness have on physician costs for patients with each diagnosis?

3. Discretionary Resources. What array of specialist and technologic resources are available for each diagnosis? How do physicians vary in use of these resources?

4. Differences in Therapeutic Approach. How much may individual physician and patient differences in therapeutic approach affect physician costs?

The 1982 Medicare data from New Jersey and North Carolina were employed to address a particular clinical concern in each of the seven examples. Each analysis concluded with speculation about potential changes in physician practices should a DRG system by adopted for physician reimbursement of that particular diagnosis. A summary of the major clinical and empirical points for each example appears in Table 1.

The specific clinical analyses and empirical studies raise a number of generic issues which may influence use of the DRG methodology to reimburse physicians. These are summarized below:

1. Definitional Precision. Many medical DRGs group together multiple, clinically heterogeneous diagnoses. For example, DRG 82: Respiratory Neoplasms contains not only primary lung cancer but also metastatic disease from any malignancy. The gastrointestinal hemorrhage DRGs include any cause and site of bleeding, from the esophagus to the anus. This could account for a portion of the observed physician cost variability. However, even when DRG caseloads were broken down into individual ICD code groupings, these

TABLE 1

SUMMARY OF ISSUES RAISED IN SEVEN CLINICAL EXAMPLES

Clinical Area	Major Clinical Issues	Empirical Analysis: 1982 Medicare Data, New Jersey and North Carolina
Cerebrovascular Disease DRGs 14, 15, 16, 17	Patients may present with very different severities. Numerous medical controversies exist about the nature and extent of diagnositc evaluation and about the type of therapy (surgical versus medical, warfarin anticoagulation versus none).	Teaching hospitals have higher Part B costs than non-teaching; the difference is much more apparent in North Carolina. Teaching hospitals do not always have a disproportionate share of outliers. Specialty of attending physician has less of an impact on costs in New Jersey than in North Carolina.
Pneumonia DRGs 89, 90, 91	The spectrum of severity of illness is very broad; the most important patient factors influencing severity are old age and comorbidity. Many discretionary resources are available for evaluating pneumonia patients.	Part B costs are very similar for DRGs 89 and 90. Cases receive similar numbers of consultations and specialists as attendings. Length of stay is longer for 89. Comorbidities are not adequately represented in these 1982 data.
Respiratory Neoplasms DRG 82	Severity of illness may bear a paradoxical relationship to costs. Numerous specialists and technologies are available. Patient preferences may strongly influence costs (e.g., choice between an aggressive approach and palliation).	Patients have multiple admissions in many different DRGs. The first 1982 DRG 82 admission had significantly higher costs than the second, particularly costs relating to diagnostic work-up.
Atherosclerosis DRGs 132, 133	Inconsistent "levels" of diagnosis produces DRGs which are clinically overlapping -- atherosclerosis (DRGs 132 and 133, pathologic process), angina (DRG 140, clinical diagnosis), and chest pain (DRG 143, symptom).	At the individual ICD code level, Part B costs also overlap among these clinically identical DRGs. North Carolina cases are more likely to receive a pathologic diagnosis (atherosclerosis), whereas New Jersey cases are more likely to receive a clinical diagnosis (angina).

TABLE 1 CONTINUED

Clinical Area	Major Clinical Issues	Empirical Analysis: 1982 Medicare Data, New Jersey and North Carolina
Gastrointestinal Hemorrhage DRGs 174, 175	Intractability of hemorrhage is a major severity issue. Patients may respond very differently to multiple diagnostic and therapeutic endeavors, with important cost implications.	Half of the patients in both states receive two or more different types of diagnostic services. New Jersey patients are more likely to receive endoscopies; North Carolina patients are more likely to receive radiologic services.
Diabetes Mellitus DRGs 294, 295	All diabetics are grouped together, including those without complications and those with DKA, renal failure, coma, neuropathy, etc. Patient attitudes may substantially influence care.	Split DRG 294 along clinical and cost lines and created subgroups with significantly different mean Part B costs (e.g., Split #2 produced Group A costs of $843 and Group B costs of $406 in New Jersey).
Red Blood Cell Disorders DRGs 395, 396	These DRGs lump together multiple different clinical entities which may generate very different costs. The states appear to be treating different diseases.	Urban North Carolina cases obtain fewer consultations than rural New Jersey cases. Split DRG 395 into subgroups with significantly different mean Part B costs.

supposedly clinically homogeneous groups continued to display considerable spread in physician costs. For example, the 1,771 cases in North Carolina grouped under ICD Code 41300, Angina Decubitus, displayed a Part B CV equaling 1.4636. Furthermore, when DRGs were broken down into individual ICD code groupings, very little of the within DRG variance was explained (e.g., for diabetes, DRG 294; R^2 with Part B cost as the dependent variable was 0.050 in New Jersey and 0.021 in North Carolina).

2. Data Quality. The 1982 New Jersey and North Carolina ICD code data suggest significant interstate differences in coding practices as well as certain potential clinical inaccuracies. Both states rely heavily upon not otherwise specified (NOS) and not elsewhere classified (NEC) codes. However, New Jersey diabetics are generally designated as "complicated" whereas North Carolina diabetics are described as "uncomplicated." The states sometimes emphasize totally different diseases. Finally, certain codes are probably inaccurate (e.g., 25% of North Carolina DRG 82 cases listed as tracheal cancer).

3. ICD-9-CM Codes. The ICD-9-CM coding nomenclature equates different "levels" of diagnoses, creating clinically overlapping groups. The DRG system thus falls into a similar trap; some of the groups are not mutually exclusive from a clinical perspective. For example, atherosclerosis (DRGs 132, 133, pathologic process), angina pectoris (DRG 140, clinical diagnosis), and chest pain (DRG 143, symptom) may describe the same patient.

4. Severity of Illness. Illness severity may have a different impact on cost depending on the clinical setting. More severely ill patients may be more expensive, equally expensive, or less expensive than less severely ill patients. For example, Part B costs were actually less for complicated and older atherosclerosis cases (DRG 132) than for "healthier" cases (DRG 133) -- by $406 in New Jersey and $69 in North Carolina. Part B costs for older, complicated pneumonia cases (DRG 89) were only slightly higher than for "healthier" cases (DRG 90) -- by $42 in New Jersey and $9 in North Carolina. Severity is also not a unitary concept that can easily be measured across diseases or DRGs. How can one compare the intractable gastrointestinal bleeder with an aphasic, paralyzed stroke patient?

5. Diagnosis as a Predictor of Costs. From the clinical perspective, diagnosis alone (or even diagnosis combined with severity) is not expected to be an accurate predictor of physician costs. This expectation stems from the extreme variability of clinical practice.

6. Discretionary Use of Resources. Even for identical patients, physicians vary widely in their use of expensive resources (e.g., consultations, diagnostic technologies). Striking regional differences arose in the comparison of New Jersey and North Carolina data. For example, in some instances, New Jersey consultation rates are two to three times North Carolina consultation rates. Urban patients generally have higher consultation rates than rural patients. Even so, urban North Carolina rates remain below rural New Jersey rates. For example, in diabetes (DRG 294), 22.2% of rural New

Jersey cases and 18.6% of urban North Carolina cases received medical consultations. The states also use very different mixes of diagnostic technologies. For example, New Jersey gastrointestinal hemorrhage patients receive more endoscopies, whereas North Carolina patients receive more radiologic services. In New Jersey, the most common exam for patients with one service type was upper endoscopy without biospy (29.2%) whereas in North Carolina, the most common service for patients with one service type was the upper gastrointestinal series (41.3%). No one knows exactly what impact the differential uses of these resources has on quality of care and patient outcome.

7. Differences in Therapeutic Approach. Absolute consensus on treatment is rare. This is due to many factors: imperfect medical information, differing individual clinical judgement, differing goals of therapy, and individual patient preference. Different therapeutic approaches may entail significantly different physician costs.

8. Marginal Changes to Hospital DRGs. Minor changes in DRG groupings may produce more equitable reimbursement levels for physicians. For example, diabetics (DRG 294) entail a broad range of clinical presentations; when costs were examined at the individual ICD code level, patients with more severe complications had higher physician costs. In an effort to refine cost groupings, DRG 294 was separated into two subgroups using four different split methodologies. Three of the four methodologies succeeded in creating subgroups with significantly different mean Part B costs in both states. For example, in New Jersey, Split #2 yielded groups with mean Part B costs of $843 and $406; Split 3 produced groups with mean Part B costs of $793 and $390. A similar exercise was likewise successful for red blood cell disorders.

These generic concerns suggest ways physicians may alter their behavior under a DRG-lump sum payment system. Several potential practices include the following:

1. "DRG Creep". Multiple opportunities exist for manipulating the listing of diagnoses to maximize reimbursement. Some of these opportunities arise from clinical overlaps inherent in the ICD system and are medically perfectly accurate. Others are more questionable from a clinical sense.

2. Pursuit of Diagnosis. Physicians may pursue exact diagnosis with varying degrees of vigor -- increased vigor if exact diagnosis moves the case to a more lucrative DRG; decreased vigor if it fails to alter reimbursement. This may result in greater use of empirical therapy, with unknown consequences for quality of care.

3. Consultations. Physicians may either obtain less consultations or ask that their consultants strive to substitute "cognitive" for "procedural" services.

4. Split Admissions. Physicians may send stabilized patients home and readmit them later for required medical or surgical therapy and procedures.

5. Earlier Triage to Surgery. If the patient may eventually need surgery, physicians may proceed earlier to surgery, skipping the less costly and more benign medical approach. However, this may result in more patients undergoing surgery who may have ultimately responded to medical intervention.

6. Case Mix. Physicians may try to avoid potentially expensive cases and admit relatively "easy" cases.

7. Transfers. Community physicians may have a lower threshhold for transferring complicated and costly cases to specialists at tertiary care centers. These specialists may then be at increased risk for financial losses.

8. Setting of Care. Physicians may endeavor to defer as many services as possible to an outpatient setting. This includes consultations as well as technologic interventions.

9. Choice of Therapy. When confronted with two potential treatments of unproven relative efficacy, a physician may choose the least expensive option.

It thus is clear that a DRG-based physician reimbursement system will affect numerous aspects of medicine -- patient/physician relationships, physician collegial relationships, physician attitudes, medical knowledge, technology introduction and review, malpractice litigation, and possibly quality of care and patient outcome. All of these aspects are of major importance. Yet despite all the speculation prior to implementation of a physician prospective payment system, no one can predict exactly how quality of care and patient outcome will be affected.

Chapter 1

INTRODUCTION

1.1 THE CLINICAL PERSPECTIVE AND PHYSICIAN REIMBURSEMENT

1.1.1 Purpose of This Report

Part B of Medicare is now the fastest growing major domestic program funded by the federal government. Estimated 1984 costs total $21 billion, with an anticipated increase of 16% between 1984 and 1985.[1] Unlike Part A of Medicare which is funded by the Hospital Insurance Trust Fund, Part B costs are paid by the Supplementary Medical Insurance Trust and beneficiary premiums. When funds from these sources are inadequate, general revenues are tapped to make up the balance. Since 1980, these general revenues have been drawn upon at an increasing rate (averaging 28.2% annually through 1983). General revenue contributions have grown from $6.6 billion in 1980 to $14.0 billion over three years, with obvious deleterious effect on the federal deficit.[2]

Given the magnitude of these budgetary concerns, Congress has mandated consideration of a program to radically alter the way physicians are paid under Part B of Medicare. The Social Security Amendments of 1983 (P.L. 98-21) stipulate that the Secretary of Health and Human Services report to Congress on the "advisability and feasibility of providing for determining the amount of payments for physicians' services furnished to hospital inpatients based on the DRG type classification of the discharges of those inpatients." This report is due to Congress on July 1, 1985.

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1 Linda H. Aiken and Karl D. Bays, "The Medicare Debate -- Round One," New England Journal of Medicine 311 (1984): 1196.

2 Stephen F. Jencks and Allen Dobson, "Evaluating Options for Reforming Medicare's Physician Payment Process," unpublished staff paper for the Health Care Financing Administration, August 1984.

A DRG-based prospective reimbursement system represents a radical departure from the way physicians are currently paid. Under the current system, physicians bill separately for each specific service rendered. Under the proposed system, physicians would be paid a single sum for an entire episode of hospital care as defined by the DRG, regardless of the cost and quantity of specific services. Studies are currently being funded by the Health Care Financing Administration to evaluate potential cost issues should DRG physician payments be implemented.[3] But what about the clinical issues?

The purpose of this report is to evaluate the DRG system as a physician reimbursement tool from a clinical perspective. This report addresses several questions:

1. What are the clinical parameters which may affect cost? Are they incorporated in the DRG rubric?

2. Are the DRGs as currently constituted (for hospital Part A reimbursement) clinically appropriate for physician reimbursement? If not, can minor adjustments be made to rectify clinical problems?

3. What are areas of potential clinical impact should the physician DRG scheme be implemented? What non-pecuniary issues -- quality of care, equity, alterations in the patient/physician relationship, for example -- may be influenced by the prospective payment plan? How might physicians alter their behavior?

The clinical perspective may be useful in additional areas as follows:

1. The clinical perspective may assist in interpretation of some empirical findings of other HCFA studies (e.g., those of Mitchell _et al._).

2. Although much has been written on the American health care system, much still remains unknown about physician practice patterns nationwide. Because of these gaps, it is impossible to fully anticipate the affect a prospective payment system would have on physician practice patterns and patient care. This report does not pretend to supply these answers; rather the clinical perspective may suggest where to begin looking for them.

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3 See Janet B. Mitchell, Kathleen A. Calore, Jerry Cromwell, Marc Freiman, and Helene Hewes, _Creating DRG-Based Physician Reimbursement Schemes: A Conceptual and Empirical Analysis_, HCFA Grant No. 18-P-98387/1-01, October, 1984.

3. The designers of a prospective reimbursement system must confront a number of thorny issues including implicitly setting practice norms by establishing fixed fees. This is made doubly difficult by several confounders -- incomplete medical knowledge about disease and therapy, the use of expensive technologies in light of these knowledge gaps.[4] The clinical perspective underscores these factors.

Given these multiple goals, the next section outlines the structure of this report.

1.1.2 Structure of the Report

Given that the purpose of this report is to look clinically at the DRG system, the report is organized around seven clinical examples.

The report includes ten chapters. The remainder of this introductory chapter looks first at the clinical input to the design of the DRG system and second at a summary overview of empirical performance of the DRG system. Chapter 2 outlines the clinical parameters used to evaluate each of the seven clinical examples and summarizes the rationale underlying the choice of each example. This chapter also briefly describes the New Jersey and North Carolina 1982 Medicare data base and its use in this report.

Chapters 3 through 9 are the clinical chapters. Each is organized in an identical fashion. After an introduction, each disease and its related DRGs are analyzed along the four clinical parameters (described in Section 2.1.1): definitional precision, severity of illness, discretionary use of resources, and differences in therapeutic approach. Following this clinical discussion is a section entitled, "State Data." In these sections, 1982 New Jersey and North Carolina Medicare data are used to explore particular topics suggested by the clinical analysis. The state data analysis is followed by a

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4 In reference to these frequent instances in which technology is used for control not cure, Lewis Thomas wrote: "It is when physicians are bogged down by their incomplete technologies, by the innumerable things they are obliged to do in medicine when they lack a clear understanding of disease mechanisms, that the deficiencies of the health-care system are most conspicuous." From "The Technology of Medicine" in <u>Lives of a Cell</u>, New York: The Viking Press, 1974, p. 36.

speculative section suggesting ways in which the particular DRGs may influence physician behavior should the prospective payment system be adopted. Each chapter closes with a summary and conclusion.

Following the seven clinical chapters is a summary chapter in which findings from all seven examples are synthesized and cross-cutting issues discussed. The report ends with recommendations for further study.

1.2 CLINICAL INVOLVEMENT IN DRG DESIGN

This report considers the use of the DRG methodology as a method to reimburse physicians. At the outset of this discussion, it is important to emphasize two underlying concerns:

1. The DRG system was designed for hospital purposes (it was originally intended to establish length of stay norms for professional standards review organizations) and used only hospital data in its development. This goal was clearly stated by the DRG designers: "The primary objective in the construction of the DRGs was a definition of case types, each of which could be expected to receive similar outputs or services from a hospital."[5]

2. Given an additional goal of ease of data collection, DRG parameters were limited to those readily available on the Uniform Hospital Discharge Data Abstract. Thus, besides age and sex, the only clinical information obtainable on a patient was discharge diagnoses in the form of ICD (International Classification of Diseases) codes and whether or not the patient died.[6]

Keeping these important caveats in mind, what was the clinical involvement in DRG design? The 470 DRGs as currently defined are actually a second generation. The original DRG system was refined at Yale in the late 1970s and consisted of 383 groups. In formulating the original DRG methodology, these Yale designers listed several "attributes" for which they were striving. The first-listed attribute was as follows:

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5 R.B. Fetter, Y. Shin, J.L. Freeman, R.F. Averill, and J.D. Thompson, "Case Mix Definition by Diagnosis-Related Groups," Medical Care 18 (1980 Supplement): 5.

6 Major surgical procedures are also coded, but this is not construed as specifically clinical information (e.g., the procedure may have been inappropriate or unnecessary).

> It must be interpretable medically, with subclasses of patients from homogeneous diagnostic categories. That is, when the patient classes are described to physicians, they should be able to relate to these patients and be able to identify a particular patient management process for them.[7]

Another attribute was that "there must be a manageable number of classes, preferably in the hundreds instead of thousands, that are mutually exclusive and exhaustive."[8]

Although as formulated these two goals are not directly competing, satisfaction of both obviously required certain trade-offs. The empirical basis of designation of the 383 original DRGs was the hospital data abstracts of 700,000 discharges from New Jersey and Connecticut. A computerized statistical algorithm (AUTOGRP) was used to partition these thousands of pieces of hospital data into empirically homogeneous groups. This methodology was adapted for "as much freedom as possible in the man-machine communication essential to the task."[9] One major purpose of this "communication" was to instill the intended medical meaningfulness into the DRG classification.

However, the initial DRG system raised certain concerns. The lack of clinical homogeneity within the groupings generated particular comment. "Clinicians were made uneasy by a number of groupings that had been statistically created, because they appeared to mix types of cases that, although similar in terms of length of stay, were clinically dissimilar."[10] When combined with additional concerns, it became clear that substantial revisions were required. The process chosen for making these revisions placed clinical issues in a leading role:

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7 Ibid.

8 Ibid.

9 Ronald Mills <u>et al</u>., "AUTOGRP: An Interactive Computer System for the Analysis of Health Care Data," <u>Medical Care</u> 14 (1976): 604.

10 Bruce C. Vladeck, "Medicare Hospital Payment by Diagnosis-Related Groups," <u>Annals of Internal Medicine</u> 100 (1984): 577.

> The new DRGs were created in successive stages. Researchers, in consultation with two advisory committees of clinicians, subdivided the international disease classifications into 23 major diagnostic categories, essentially on the basis of organ systems and clinical specialties. Each diagnostic category was subdivided into cases that included a surgical procedure ordinarily done in an operating room, and those (presumptively medical) cases in which there were none. The categories were further subdivided, using AUTOGRP (an iterative computer program that identifies clusters of diagnoses relatively homogeneous in terms of length of stay, and established the variance reduction that can be obtained by further splitting those groups) on the basis of patient age, the presence of comorbid or complicating conditions, and discharge status (dead or alive)... These initial splits were reviewed and refined by the clinician advisors, then revised and retested until, within each major diagnostic category, there was a categorization that satisfactorily met the criteria of homogeneity within the group, clinical plausibility, and statistical relability.[11]

The data base used for these revisions was more nationally representative than that employed in the original system. The new analysis used a national sample of 1.4 million discharges as well as 330,000 New Jersey cases.

Several tiers of physicians were tapped for clinical input throughout this process -- over 100 doctors were involved. A team of three Yale-New Haven based physicians played the lead role for day-to-day issues. These three physicians included a surgeon, an internist, and a medical subspecialist. Advisory committees of clinicians met monthly in Washington, D.C., in addition to a group of clinical subspecialists who met separately in New Jersey (New Jersey was beginning experimentation with an all-payor DRG hospital reimbursement scheme, thus New Jersey physicians were particularly concerned and informed). In addition Yale researchers met at least once with a representative of each of the clinical groups serving as advisors to the International Classification of Diseases - 9 - Clinical Modification committee.[12]

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11 Ibid., p. 578.

12 Personal communication, Dr. Robert Mullin. Dr. Mullin is the surgeon who served on the Yale-New Haven team.

Thus is appears that more diligent attention was paid to clinical issues in the second iteration. Despite this, the trade-offs which were required in the original design remained for the subsequent effort. Although the number of groups expanded from 383 to 470, they remained limited. Obviously, the goal of clinical homogeneity is best served by maximizing the number of groupings (if one agrees that each disease entity and indeed each patient is unique) and by incorporating clinical information not collected on the hospital discharge abstract (e.g., on illness severity). This latter factor was not an option for the DRG system. But it is not clear exactly what guided the trade-off of the first factor -- clinical homogeneity versus limiting the number of groups.

In conclusion, it is important to return to the caveats listed at the outset. Although it appears that clinical attention was paid during DRG development, the emphasis was on hospitals. The clinicians involved focused on hospital not physician issues; they may in fact be different.[13] Two examples highlight these differences:

1. A patient is admitted to a general ward of the hospital with diabetic ketoacidosis. The private physician must remain near the bedside of that patient, continually monitoring blood sugar and electrolyte levels and adjusting the insulin dose and electrolyte replacement. The cost of the tests and medication is fairly minimal to the hospital, but may require hours of physician time.

2. A patient is admitted to the hospital for initial treatment of a severe burn. The physician visits daily to make sure the patient is stable, amply hydrated, and free from infection. However, the majority of the costs belong to the hospital in the form of meticulously regulated environment, specialized bed and equipment, and intensive nursing care.

Thus, in certain settings the major cost burden may fall upon the physician while in others it may most influence the hospital.

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13 Personal communication, Dr. Mullin. The clinical examples were suggested by Dr. Mullin. If the first patient is ill enough to require intensive care unit monitoring, obviously hospital costs would be much higher. Also if this patient were admitted to a teaching hospital, a house officer would perform these duties, at hospital expense.

Finally, the only specific clinical information available for DRG designation is age, sex, death, and discharge diagnoses, as defined by ICD-9-CM. However, as will become clear in the clinical chapters, ICD code alone is a woefully inadequate descriptor of diagnosis, let alone medical status of patients.[14] One of the goals of the DRG designers was to create mutually exclusive groups. Yet, by confusing level of diagnosis (symptom, clinical diagnosis, pathologic diagnosis, clinical event) the ICD system itself fails to create mutually exclusive categories. The DRGs thus by default fall into the same trap.

1.3 SUMMARY OF EMPIRICAL ANALYSIS OF DRG PERFORMANCE[15]

Although this report is not intended to be a statistical analysis of DRG performance, a number of empirical findings form an important backdrop to this clinical study. These empirical results were developed using 1982 Medicare data from New Jersey and North Carolina to model the performance of DRGs in several areas.

Given that a major goal of the DRG methodology was to group cases with like costs, an important first question is: how well did the DRGs do in creating homogeneous cost groups? A preliminary answer is grounded in measuring coefficients of variance (CV = standard deviation/mean cost) within DRGs. The CV suggests how tightly individual costs are grouped around the mean cost. Increasing CVs indicate widening spread. A CV of one, for example, suggests that two-thirds of the cases fall into the region ranging from zero to two times the mean cost (mean cost plus or minus one standard deviation). Projections using the CV, however, assume that costs are normally

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14 See Chapter 6 for a detailed discussion of problems in cardiovascular ICD codes.

15 The statistical information presented in this section is taken from Mitchell *et al*. The 1982 Medicare data base used in this report is the same as that used by Mitchell *et al*.

distributed. As shown in Figure 1.1 this is usually not the case. Cost distributions are generally skewed, with very long right tails. This tends to draw the mean value above the median value, and to increase the standard deviation. Given this caveat, how do the Part B DRGs fare?

The DRGs display a wide range of Part B CVs.[16] CVs range from .02 to 1.57 in New Jersey and from .02 to 2.48 in North Carolina.[17] In New Jersey, 11 surgical and 110 medical DRGs have Part B CVs of .90 and above. In North Carolina, 4 surgical and 154 medical DRGs have Part B CVs of .90 and above. On the opposite end of the spectrum, 90 surgical and 8 medical DRGs have CVs of .40 and lower in New Jersey; comparable figures for North Carolina are 95 surgical and 2 medical DRGs. (The distribution of medical and surgical DRG Part B CVs for New Jersey and North Carolina appears in Figures 1.2 and 1.3; the total number of DRGs does not add to 470 because some DRGs have zero cases.) In both states, the medical DRGs with high CVs include some of the most important DRGs, those with large volumes. For example, representative New Jersey DRGs include those for pulmonary edema (DRG 87, 2384 cases, CV = 0.90), lymphoma and leukemia (DRG 403, 1314 cases, CV = 0.92), digestive malignancy (DRG 172, 1770 cases, CV = 0.99), angina (DRG 140, 9488 cases, CV = 1.00), chronic obstructive pulmonary disease (DRG 88, 4839 cases, CV = 1.30), and atherosclerosis (DRG 132, 2427 cases, CV = 1.30). Representative North Carolina DRGs include stroke (DRG 14, 7021 cases, CV = 0.90), pneumonia (DRG 89, 4714 cases, CV = 0.92), heart failure (DRG 127,

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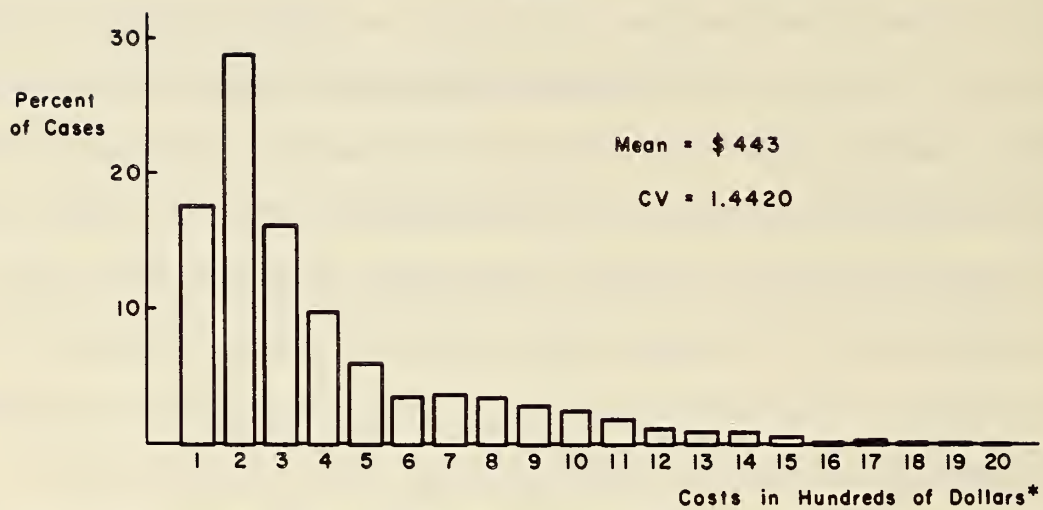
16 Part A CVs are generally higher than Part B CVs with an important exception -- a number of the high volume medical cardiovascular DRGs have greater Part B CVs. See Mitchell *et al.*, Section 4.2.3. A potential explanation for the cardiovascular exception appears in Chapter 6.

17 In New Jersey, DRG 380 had a Part B CV of .02 but only had two cases. In North Carolina, DRG 259 had a Part B CV of .02 but also only had two cases. Several of the DRGs with the lowest Part B CVs have very small volumes. See appendix to Mitchell *et al.*

Figure 1.1
Distribution of Part B Costs
DRG 133 : Atherosclerosis
Age <70 w/o C. C.
North Carolina
N = 2534



*22 cases (0.87 %) remained above this $ 2000 cut-off. 17 of these cases were $ 5000 or over, with the maximum cost equalling $ 8300.

Figure 1.2
Distribution of Coefficients of Variance for Medical and Surgical DRG Part B Costs : New Jersey

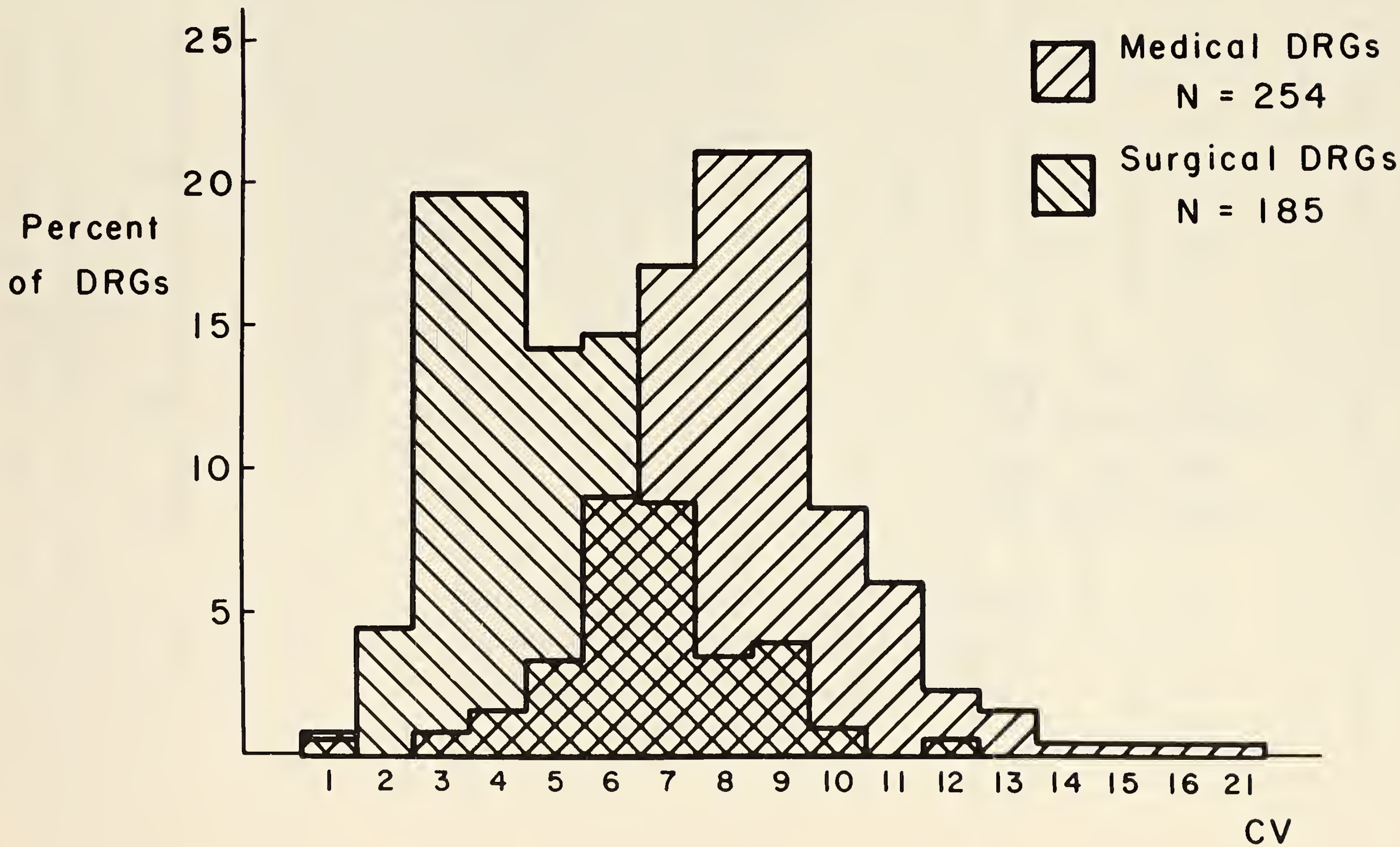
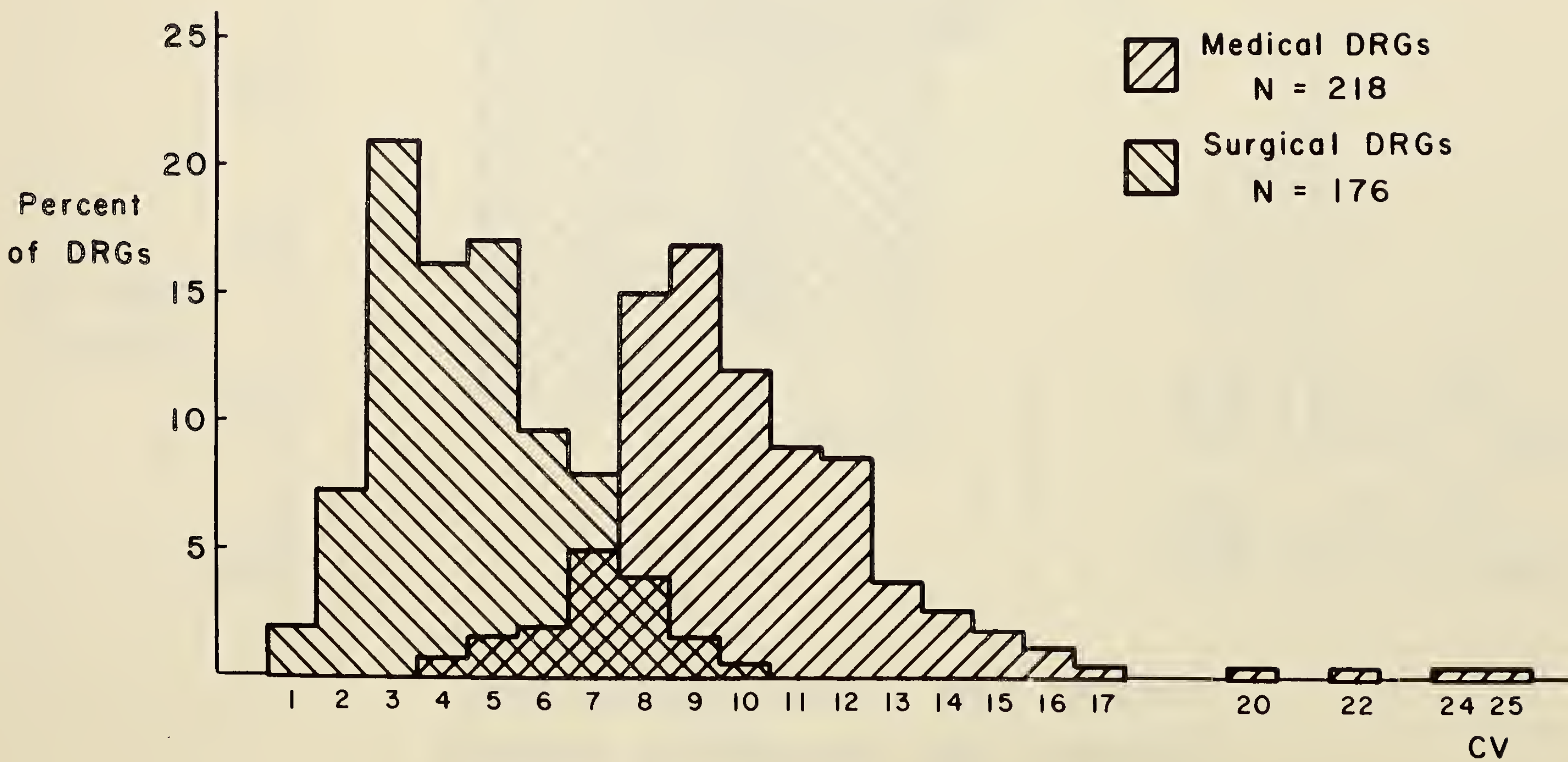


Figure 1.3
Distribution of Coefficients of Variance for Medical and Surgical DRG Part B Costs: North Carolina



7711 cases, CV = 0.94), miscellaneous digestive disorders (DRG 182, 8316 cases, CV = 0.94), cardiac arrhythmias (DRG 138, 3788 cases, CV = 1.23), and peripheral vascular disorders (DRG 130, 2158 cases, CV = 1.51). Thus, the DRGs with the most heterogeneous costs include some of the most costly in the system.

As emphasized above, surgical DRGs have systematically lower CVs than medical DRGs. This is not surprising given the different way in which surgical and medical illnesses are approached by their respective practitioners. Surgical practices are more homogeneous in terms of required specialist input and nature of services. Patients presenting to surgeons are not as often the diagnostic dilemmas requiring multiple diagnostic technologies or multi-specialty consultations as those presenting to medical doctors. In fact certain surgeries may represent a referral for the ultimate diagnostic procedure once medical investigations have failed to find an answer. Also, surgical fees comprise such a large proportion of the total physician bill that they tend to overwhelm variation in less expensive physician services (e.g., medical consultation prior to surgery). Thus the variation in resource use is more limited for surgical cases. Because the performance of medical DRGs is so much more problematic than that of surgical DRGs, the focus of the clinical examples will be medical DRGs alone. Certain general problems for surgical DRGs will be mentioned in Chapter 10.

The issue of cost variation can be approached from the opposite direction by posing the question: how well does the DRG methodology explain the observed variation in physician costs? Applying analysis of variance techniques to the physician cost data yields the R^2s which are arrayed in Table 1.1. When all DRGs are considered together, they explain more than half of physician cost variability; this performance improves when outliers are

TABLE 1.1

VARIATION IN PART B PHYSICIAN COSTS EXPLAINED BY DRGS[a]

DRGs	NEW JERSEY R^2 Untrimmed Data	NEW JERSEY R^2 Trimmed Data	NORTH CAROLINA R^2 Untrimmed Data	NORTH CAROLINA R^2 Trimmed Data
All DRGs	0.57	0.70	0.57	0.75
Medical DRGs Only	0.05	0.07	0.03	0.06
Surgical DRGs Only	0.53	0.62	0.64	0.71

a Taken from Mitchell et al., Table 4-6. Trimmed data excludes outliers defined as those cases exceeding three standard deviations from the geometric mean. Geometric mean is chosen because it compensates for extreme outliers better than the arithmetic mean.

excluded. However, when DRGs are split into medical and surgical groups, a striking difference appears. Virtually all of the explanatory power of the DRG system is attributable to surgical DRGs. The medical DRGs fare very poorly.

> What do these findings mean for DRG-based payment for inpatient physician services? For surgical admissions, they suggest that DRG payments should represent reasonable reimbursement for the costs incurred in treating those cases. For medical admissions, on the other hand, DRG-specific payments will bear no relationship to costs in most instances. Whether a physician wins or loses on any one case will be largely random.[18]

Adapting the DRG system to individual physician reimbursement confronts a major conceptual concern: it is taking an epidemiologic construct extracted from review of thousands of cases (hospital cases, as mentioned in the last section) and applying the results at an individual level. DRG fees will not always approximate actual cost. At the hospital level, Medicare caseloads are

18 Mitchell et al., p. 4-16.

expected to be large enough that gains and losses on individual hospitalizations would cancel out. Net gains would thus be zero. But these data suggest that physicians treating medical cases may be at considerable risk.

The average medical doctor hospitalizes a fairly small contingent of Medicare patients annually. Medicare caseloads vary by speciality. The largest caseloads are for New Jersey internists (65.3 cases per year) and cardiologists (66.7) and for North Carolina internists (65.5) and general practitioners (66.5). Smaller caseloads were found for New Jersey general and family practitioners (33.4 and 32.5 cases per year respectively) and for North Carolina family practitioners (31.9). The average physician admits cases in 18 different DRGs. Therefore splitting physician caseloads into individual DRGs yields very few patients per DRG. For example, New Jersey and North Carolina internists admit 2.3 cases per DRG whereas family practitioners admit 1.7 cases per DRG.

Because of these small numbers, there is very little room for gains to cancel out losses at the DRG level for indiviudal physicians. Applying a fixed mean urban-rural DRG payment to physician produced predictable winners and losers due to the redistributive effect (general practitioners and family practitioners tend to have lower fees and would thus gain from a payment skewed upwards by specialist fees). Gains and losses by specialty appear in Table 1.2. Individual per case shortfalls and windfalls would not be a great problem if they cancelled out across a physician's entire Medicare hospital caseload. However, when the possibility of cancelling out across DRGs was examined, it was found to be fairly limited. When physicians gained in one DRG, they tended to gain in all and vice versa.

TABLE 1.2

COMPARISON OF GAINS AND LOSSES BY SPECIALTY:

DOLLARS PER CASE[a]

Specialty	New Jersey	North Carolina
General Practice	+74	+66
Family Practice	+59	+46
Internal Medicine	-16	-63
Cardiology	-69	-230
Gastroenterology	-132	-243
Pulmonary Disease	-154	-251

a Taken from Mitchell *et al*., Table 6-5.

This brief empirical overview thus places the ensuing clinical analyses into context. The major points raised by the empirical study are summarized below:

1. Part B CVs of medical DRGs are systematically greater than those of surgical DRGs.

2. The DRG groupings overall explain more than half the variation in physician costs. However, when explanatory power is evaluated separately for medical and surgical DRGs, the medical DRGs do very poorly. Virtually all the explanatory power of the DRG methodology resides in the surgical groupings.

3. Individual physicians admit fairly small numbers of Medicare patients to the hospital annually. These small numbers of patients fall into many different DRGs. Thus there is very limited opportunity for gains and losses per case to cancel out at the DRG level. Even across DRGs, cancellation of cost windfalls by shortfalls appears minimal.

Because the DRG system appears particularly problematic for the medical groups, the emphasis of this clinical analysis is the medical DRGs.

Chapter 2

METHODOLOGY

2.1 CLINICAL APPROACH

As noted in the introduction, the purpose of this report is to explore the problems of the medical DRGs from a clinical perspective. To guide this exploration, seven examples were chosen from the ranks of the medical DRGs. Each was then evaluated along a parallel set of clinical parameters. This section first explains the rationale underlying the choice of the clinical parameters, and second describes the selection process and choices of the seven clinical examples.

2.1.1 Rationale for Clinical Parameters

The statistical results summarized earlier yield a fairly clear conclusion: the medical DRGs are grouping together cases with widely varying costs. Why? To address this question, we stepped down to a more fundamental level, and rephrased the query: from a clinical perspective, what factors are important in predicting cost? We focused our response upon four major areas, which we then adapted to our DRG analyses. These four areas became the clinical parameters which are presented below.

2.1.1.1 Definitional Precision

Despite the original goals of the DRG designers to create clinically coherent groupings, the DRGs lump together multiple clinical entities. The diagnoses are not precisely and tightly defined. The genesis of this problem is two-fold. First, the DRGs are based upon the ICD code diagnoses listed on the discharge abstract. However, as the seven clinical examples will show, the ICD code is often an inadequate proxy for diagnosis. Many of the most frequently used ICD codes list a very general condition followed by the suffix NOS (not otherwise specified) or NEC (not elsewhere classified). These codes are intentionally vague to capture the residual cases remaining from more specific codes. But unfortunately most cases in certain DRGs fall into these poorly defined diagnoses. Furthermore, the ICD codes often capture in detail information which is not the most pertinent to clinical course, outcome and resource consumption. This is a particular problem in the area of cancer. The ICD coding for lung cancer, for example, focuses on the anatomic site of the malignancy: is the tumor in the trachea, bronchus, upper lobe, lower lobe? However, it does not capture the type of cancer -- adenocarcinoma, squamous cell, small cell. These are the most important factors for treatment and prognosis (see Chapter 5). Finally, the ICD codes often equate differing "levels" of diagnoses (symptoms, clinical diagnoses and events, pathologic processes), yielding categories which are clinically not mutually exclusive. The DRG system mimics this problem. The clearest examples are the chest pain (symptom), angina (clinical diagnosis), and atherosclerosis (pathologic process) DRGs described in Chapter 6.

Second, the DRGs group together ICD codes which represent widely varying clinical entities. Such heterogeneity was inevitable given the goal of minimizing the number of DRGs, but it may contribute to an unacceptable degree of cost variation when it comes to the level of the individual physician. This latter point raises the greatest physician-specific concern. Obviously, definitional imprecision within the DRG system would affect both Part A and Part B reimbursement. But physicians are more vulnerable because the protective influence of the law of large numbers may not apply.

2.1.1.2 Severity of Illness

The DRG system overall suffers from its inability to adequately capture "severity of illness." The hypothesis underlying concern about this shortcoming is that sicker patients are more costly. This oft-quoted assertion may in fact not always hold, particularly at the extremes. For example, terminally ill patients who die soon after admission may incur fairly low costs. At the other extreme, patients who have minimal symptoms may be admitted for extensive and expensive diagnostic work-ups. Even within a given severity level, intensity of service is not always predictable, often due to patient preference. One example is a patient with end-stage disease who asks that heroic measures not be taken to prolong his life. Another patient with similar disease may make the exact opposite request. These two patients may incur significantly different costs. Thus, severity of illness is not always directly proportional to expense. But in most cases it is probably an important consideration which should optimally be incorporated into the reimbursement methodology.

Once again this issue has impact upon both Parts A and B, but the physician may be more vulnerable because of his relatively small caseload. There may in fact be groups of physicians whose patients are skewed toward the sicker end of the severity continuum -- for example, physicians who treat many impoverished elderly. Also, certain DRGs are more susceptible to critique about this problem than others. One clear example is the adult diabetes DRG which groups together patients with uncomplicated diabetes with those suffering blindness, renal failure, peripheral vascular disease, and coma (see Chapter 8). Obviously, these patients may incur widely varying costs.

2.1.1.3 Discretionary Resources

Given the ever-expanding array of specialists and medical technologies available, physicians have a large number of resources to tap in caring for patients. One can easily imagine multiple scenarios in which patients with identical diagnoses and severities of illness have extremely disparate costs due to the varying intensity with which these discretionary resources are used in their care. Gastrointestinal hemorrhage patients are particularly susceptible to such variability. One physician may feel that a barium enema x-ray is adequate for the evaluation of a lower gastrointestinal tract bleed. But if that test yields inconclusive evidence, a second physician may ask a gastroenterologist to perform a colonscopy; if that fails, a third physician may ask a radiologist to administer a nuclear medicine scan (see Chapter 7).

The use of such specialized resources has probably been a major contributor to the cost escalation of medicine in the last decades. However, it is equally probable that many of the advances have contributed significantly to improved prognosis and quality of care. In some communities, patterns of high discretionary resource use may have become the accepted "standard of care." Patients may expect referrals to specialists when particular problems arise. Indeed, patients rate the willingness to refer to specialists as a highly desirable trait in a primary care physician.[19] Because intensive resource use is the locally accepted practice, a physician may be afraid to depart from this pattern due to medicolegal concerns (e.g., how would it look in court if Dr. A. did not obtain a CT scan when all his colleagues testify that they would have done so?). The cost impact of this "defensive medicine" practice style may be substantial.

Although discretionary resource use has major Part A implications, the Part B costs move in parallel. Every one of the expensive technologies (e.g., CT scan) requires a specialist to interpret it (e.g., neuroradiologist). Similarly, specialist consultation fees may not influence only Part B. Specialists are thought to often increase cost by suggesting additional tests. For example, in one study, 70% of inpatient consultations lead to the use of

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19 P.B. Price et al., "Attributes of a Good Practicing Physician," Journal of Medical Education 46 (1971): 229-237.

at least one additional test or procedure.[20] Thus, differential use of discretionary resources could contribute to variation observed in the costs of treating identical patients.

2.1.1.4 Differences in Therapeutic Approach

Despite the technologic advances alluded to above, many issues remain unresolved in medical therapeutics. Because clinical studies have yielded contradictory or conflicting results, physicians may feel justified in treating identical patients in very different ways. Different therapies may carry significantly different costs. For example, although stroke is one of the most common events in an elderly population, physicians continue to disagree on the definitive treatment (or prophylaxis against further stroke). The different medical and surgical options may result in substantially divergent costs (see Chapter 3). Each side of the therapeutic controversy cites studies on its own behalf, but consensus has yet to be reached. These disagreements have implications for both Parts A and B of the reimbursement system.

2.1.2 Choice of Medical DRGs

The body of this report examines seven clinical examples illustrative of the issues surrounding the medical DRGs.

2.1.2.1 Criteria Used in DRG Selection

Each of the seven clinical examples contains from one to four medical DRGs. The examples with more than one DRG include all the DRGs specifically referable to a given clinical condition; cerebrovascular disease, for example, contains stroke (DRG 14), transient ischemic attacks (DRG 15), and "nonspecific" cerebrovascular disorders (DRG 16 with comorbidities and complications, DRG 17 without).

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20 T. Lee, E.M. Pappius, and L. Goldman, "Impact of Inter-Physician Communication on the Effectiveness of Medical Consultations," American Journal of Medicine 74 (1983): 106-112.

Several considerations governed the choice of the examples. The first considerations were based upon the 1982 New Jersey and North Carolina Medicare results: relatively large caseload and relatively high cost heterogeneity (as manifest by magnitude of the coefficient of variance). The second considerations were clinical -- that the DRGs raise interesting clinical issues illustrative of the points identified by the four clinical parameters. Certain DRGs focus more on one parameter than another. Therefore, in choosing the DRGs, an attempt was made to select a complement of DRGs which would fully address all four parameters.

2.1.2.2 Description of Selected DRGs (See Table 2.1)

Cerebrovascular Disease (DRGs 14, 15, 16, 17). These DRGs raise concerns along all four clinical parameters. Severity of illness is an important issue: for example, stroke patients with isolated tingling in one hand may incur substantially different costs from the aphasic patient with a dense hemiplegia. The discussion also focuses on controversies in therapeutic approach, outlining the various medical options (which have very different costs) and the appropriate use of surgical intervention.

Pneumonia (DRGs 89, 90, 91). The major clinical issues raised by the pneumonia DRGs involve severity of illness and the broad range of discretionary resources. However, these DRGs are at risk due to the generic ICD code problem alluded to earlier -- confusing levels of diagnosis. Because of this and because of the clinical importance of comorbidity in pneumonia patients, the pneumonia DRGs may prove a fertile ground for "DRG creep."

Respiratory Neoplasms (DRG 82). Definitional precision is an important issue; DRG 82 contains both primary lung cancer and metastatic disease. Severity of illness may present a paradox common to most oncologic disease -- costly initial evaluation and less expensive terminal care. Differences in

TABLE 2.1

SUMMARY OF SEVEN CLINICAL EXAMPLES

Clinical Area	DRGS	Major Clinical Issues	State Data Analysis
Cerebrovascular Disease	DRGs 14, 15, 16, 17	Severity of illness; differences in therapeutic approach	Comparison of teaching versus non-teaching hospital experience; impact of physician specialty on cost
Pneumonia	DRGs 89, 90 91	ICD code concerns; severity of illness; discretionary resource use	Comparison with related DRGs; impact of comorbidity
Respiratory Neoplasms	DRG 82	Severity of illness; discretionary resource use; differences in therapeutic approach	Description of readmission patterns; comparison of costs of first and second DRG 82 admission
Atherosclerosis	DRGs 132, 133	ICD code problems; DRGs not clinically mutually exclusive	Comparison with Angina (DRG 140) and Chest Pain (DRG 143) data
Gastrointestinal Hemorrhage	DRGs 174, 175	Severity of illness; discretionary use of resources	Description of surgical and radiologic procedures received by New Jersey and North Carolina patients
Diabetes Mellitus	DRGs 294, 295	Severity of illness; differences in patient and physician treatment philosophy	Urban/rural comparison; split DRG into subgroups with different mean costs
Red Blood Cell Disorders	DRGs 395, 396	Definitional precision	Urban/rural comparison; split DRG into subgroups with different mean costs

discretionary resource use and approaches to treatment may present significant cost implications.

Atherosclerosis (DRGs 132, 133). The atherosclerosis DRGs also clearly expose some of the problems inherent in the ICD classification system. Because of the way these DRGs are defined, they do not form clinically mutually exclusive categories with the angina and chest pain DRGs (140 and 143). Therefore, these cardiovascular DRGs offer the perfect opportunity for "DRG creep."

Gastrointestinal Hemorrhage (DRGs 174, 175). Definitional imprecision and widely varying severities of illness are important problems for these DRGs. But the focus of this discussion is the large number of discretionary resource options. Perhaps only second to cardiology, gastroenterology has become the most procedure oriented of all medical subspecialties. Varying utilization of this panoply of technologies may contribute to substantial cost variation.

Diabetes (DRGs 294, 295). Severity of illness is of greatest importance in this chapter, but the emphasis is on the broad range of presentations of diabetes itself (not comorbidities, as in the pneumonia discussion). Early in its course, diabetes may be an uncomplicated condition. However, the development of long-term chronic complications is inevitable; along the way, a patient may also suffer acute, life-threatening events. These variations are not adequately addressed in the diabetes DRG definition.

Red Blood Cell Disorders (DRGs 395, 396). Definitional imprecision is the most significant issue in this discussion. Although on the surface it appears that these DRGs nicely group together all anemias, from the clinical perspective the disorders are extremely heterogeneous.

2.2 NEW JERSEY AND NORTH CAROLINA DATA SETS AND ISSUES

This report is not intended to be an empirical analysis of using the DRG classification methodology for physician reimbursement. However, data are used descriptively throughout the report, and in each clinical chapter, a brief analytic section employs the data to explore specific clinical concerns.

The data base is 1982 Medicare Part A and B claims for New Jersey and North Carolina. The hospital and physician claims were merged at the patient level to create a file rich in information on service utilization and costs. The data base was created by the Center for Health Economics Research, Chestnut Hill, MA, under HCFA Grant No. 18-P-98387/1-01. The methods used in creation of this data file are extensively described in the first year report for this HCFA grant.[21]

Except in a number of specific instances, the data presented in this report are "untrimmed" -- outliers (defined for the hospital DRG system as cases exceeding three standard deviations from the geometric mean) were not removed. This choice was made for the two following reasons:

1. One purpose of this report is to reflect the range of physician practice and of clinical issues. Although a prospective payment methodology will have to consider how to deal equitably with extremes, at this point it may be helpful to understand clinically what those extremes are.

2. The Center for Health Economics Research work demonstrated that hospital and physician cost outliers are generally different cases. "The overlap is fairly limited; only one-fifth of New Jersey outliers and one-eighth of those in North Carolina had both physician and hospital costs that exceeded the trim points."[22] Creating an integrated outlier policy may become an important policy issue, but for this preliminary clinical overview, we chose to incorporate all cases.

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21 See Sections 3.1 through 3.5, in Janet B. Mitchell *et al.*, *Creating DRG-Based Physician Reimbursement Schemes: A Conceptual and Empirical Analysis*, HCFA Grant No. 18-P-98387/1-01, October, 1984.

22 Ibid., p. 4-12.

Throughout the report, the coefficient of variance (CV = standard deviation divided by mean) is frequently cited as a measure of the heterogeneity of values for a particular parameter. The CV is used only as a descriptive statistic. A number of other standard statistical tests are also performed. All summary statistical results must be interpreted with the following caveat: most of the parameters described in this report have values which are not normally distributed, but are skewed to the right with very long right tails. This is particularly true of the cost data. For example, in North Carolina the mean physician cost of treating an atherosclerosis case (DRG 132) was $374 but the standard deviation was $478 (CV = 1.2770). As was shown in Figure 1.1, the long right tail skews the mean upward and underlies the large standard deviation. One final caveat involves the interpretation of tests of statistical significance. The numbers involved in these tests are large, generally well into the thousands. Therefore, even relatively small differences may appear statistically significant. Statistical significance in this setting may not be identical to policy significance.

2.3 ADDITIONAL INFORMATION USED IN THE ANALYSES

The clinical discussions are not intended to be in-depth reports on particular medical problems. Instead they are meant to be brief overviews of medical topics which illustrate particular analytic points. Where necessary and appropriate, standard medical textbooks and review articles from major medical journals were consulted. These sources are cited throughout each chapter. The chapters were extensively reviewed by several Boston University physicians to ensure the accuracy of the clinical discussions.

Due to the unique definitional problems of the atherosclerosis DRGs (132, 133), a small data collection effort was launched to address a question which could not be answered by the aggregate Medicare data sets: what are the clinical presentations of the patients who are assigned to these DRGs? Twenty-two patient charts were reviewed at University Hospital (the methodology of this review is described in Chapter 6). The review is not meant to yield the definitive picture of these patients. Rather it is intended to suggest an area where further research may be needed.

Chapter 3

CEREBROVASCULAR DISEASE: MEDICAL DRGS

DRG 14: Specific Cerebrovascular Disorders Except TIA

DRG 15: Transient Ischemic Attack (TIA)

DRG 16: Nonspecific Cerebrovascular Disorders with c.c.

DRG 17: Nonspecific Cerebrovascular Disorders without c.c.

3.1 INTRODUCTION

Cerebrovascular disease (CVD) includes a wide range of disorders affecting the blood vessels of the brain, such as strokes and transient ischemic attacks (TIAs). These problems are particularly common in the elderly population, as reflected in their large caseloads: 15,199 cases in New Jersey and 11,004 cases in North Carolina. In fact these four DRGs involve more cases than the combined caseloads of the 23 other medical DRGs in MDC 1. From the cost perspective also, CVD is important. Part A costs for these four DRGS totalled $45,936,398 in New Jersey and $23,516,124 in North Carolina; Part B costs equalled $10,382,144 in New Jersey and $4,331,639 in North Carolina. Nationwide, the annual cost of CVD to Medicare is well over one billion dollars.

From a cost containment perspective, therefore, evaluation of CVD DRGs is essential. This issue may even increase in importance as the American population ages. However, review of data from New Jersey and North Carolina reveals that cost variations within these four DRGs are quite high (see Table 3.1). Can a clinical analysis suggest potential sources of this variation? The answer rests on three levels as follows:

1. Each of the CVD DRGs contains a variety of clinical entities;
2. Each unique clinical entity can present with widely varying degrees of severity; and

TABLE 3.1

COEFFICIENTS OF VARIANCE: PART A AND B COSTS

FOR DRGS 14, 15, 16 and 17

	DRG 14		DRG 15		DRG 16		DRG 17	
State	Part A	Part B	Part A	Part B	Part A	Part B	Part A	Part B
New Jersey	1.0130	0.7360	0.9030	0.6910	0.8500	0.6970	0.8380	0.7580
North Carolina	1.0820	0.9020	1.1060	1.0970	--	--	1.0890	1.0340

3. For each degree of severity within each clinical entity, the diagnostic and management approach may be quite different for different patients.

This chapter examines each of these clinical issues in detail. Although CVD is a very common disease, many diagnostic and therapeutic controversies -- with important cost implications -- remain.

3.2 DEFINITIONAL PRECISION

In DRGs 14 through 17, the top five five-digit ICD codes account for 94.3% to 98.2% of New Jersey and North Carolina cases (see Figure 3.1). Overall, the ICD codes in these four DRGs appear to represent a fairly homogeneous pathologic process, blockage of cerebral arteries. The few exceptions (e.g., Code 43000, Subarachnoid hemorrhage, in DRG 14; Code 34830, Unspecified encephalopathy, in DRGs 16 and 17; and Code 34880, Other conditions of brain: cerebral calcification and fungus, in DRG 17) do not contain sizeable caseloads. However, two concerns arise from examining the ICD coding patterns in these DRGs:

1. The major ICD codes in each DRG (Code 43600, Acute but ill-defined CVD, in DRG 14; Code 43590, Unspecified transient cerebral ischemia, in DRG 15; and Codes 43790, Unspecified CVD, and 43700, Cerebral atherosclerosis, in DRGs 16 and 17) are themselves catch-all codes. Whenever the words "unspecified" or "ill-defined" appear in the ICD code, questions are raised about the quality of the information from which the codes were determined. These codes are also sufficiently broad that they might represent patients with very different clinical conditions and needs.

2. ICD coding appears to be practiced somewhat differently in New Jersey and North Carolina. The most striking example, DRG 16, is a historical artifact. Although 288 New Jersey cases fall into this category, no North Carolina cases do. DRGS 16 and 17 are identical except for the addition of a co-existing condition in DRG 16. North Carolina did not code secondary diagnoses until they were required by law in 1983, so this stratifier was not available on the 1982 data, and all North Carolina cases were placed into DRG 17. A more relevant albeit subtle difference appears in DRG 15, TIAs. In New Jersey, 80.8% of cases fall under the broad rubric of Code 43590, Unspecified transient cerebral ischemia. In North Carolina only 42.3% are given this diagnosis, while 46.7% are labelled with the more specific Code 43500, Basilar artery syndrome. While this case

Figure 3.1A
Five Most Common ICD Diagnoses in DRG 14

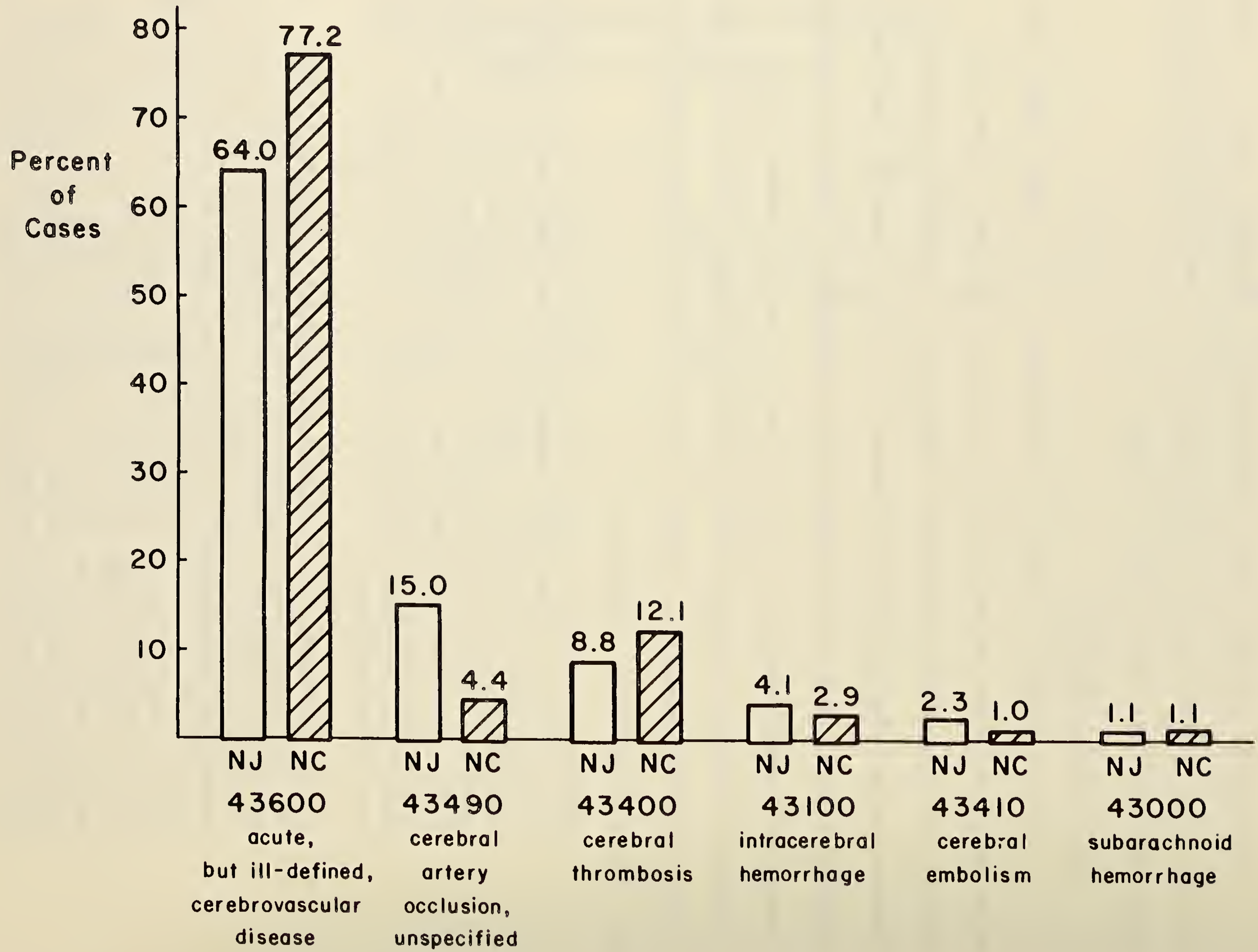


Figure 3.1B
Five Most Common ICD Diagnoses
in DRG 15

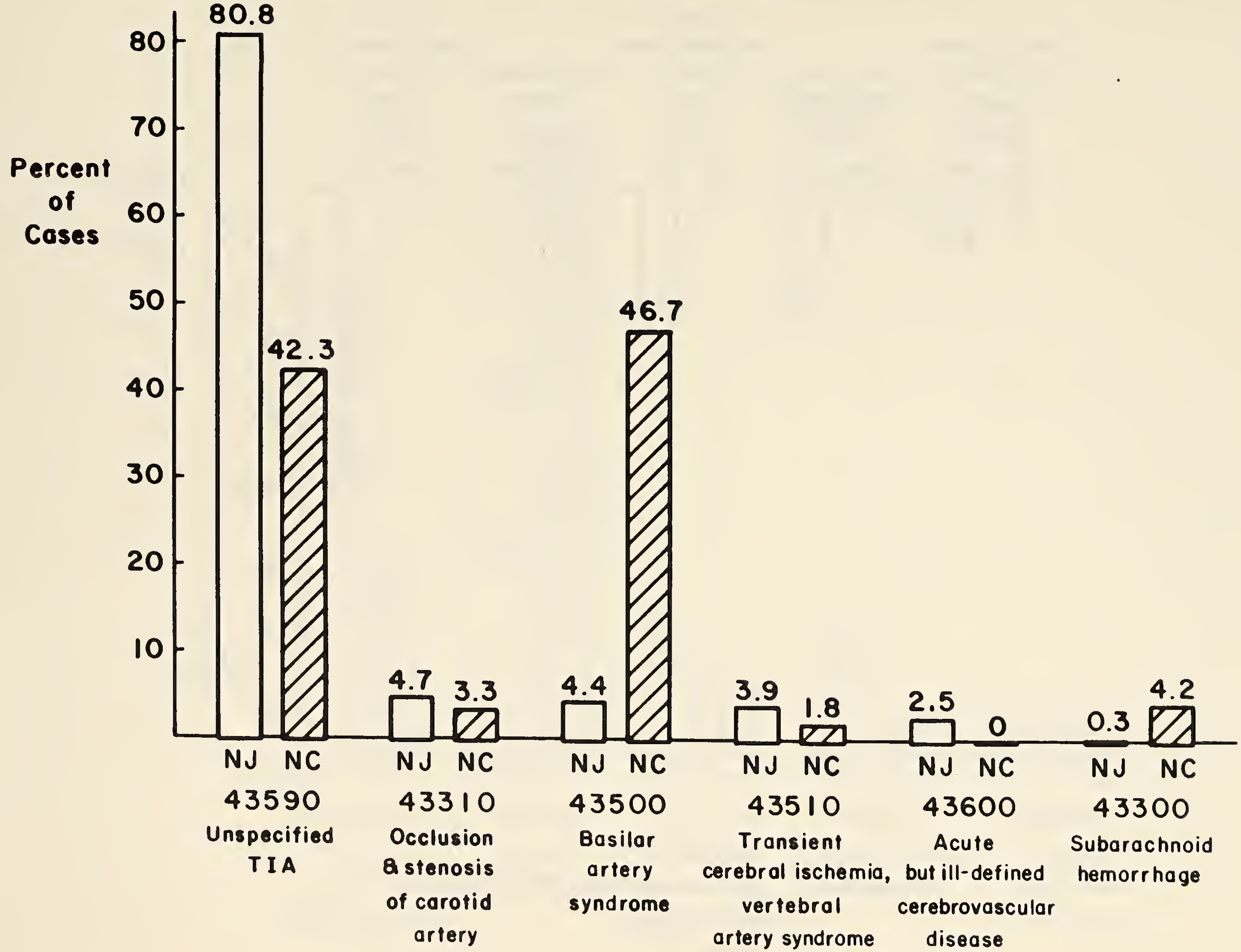
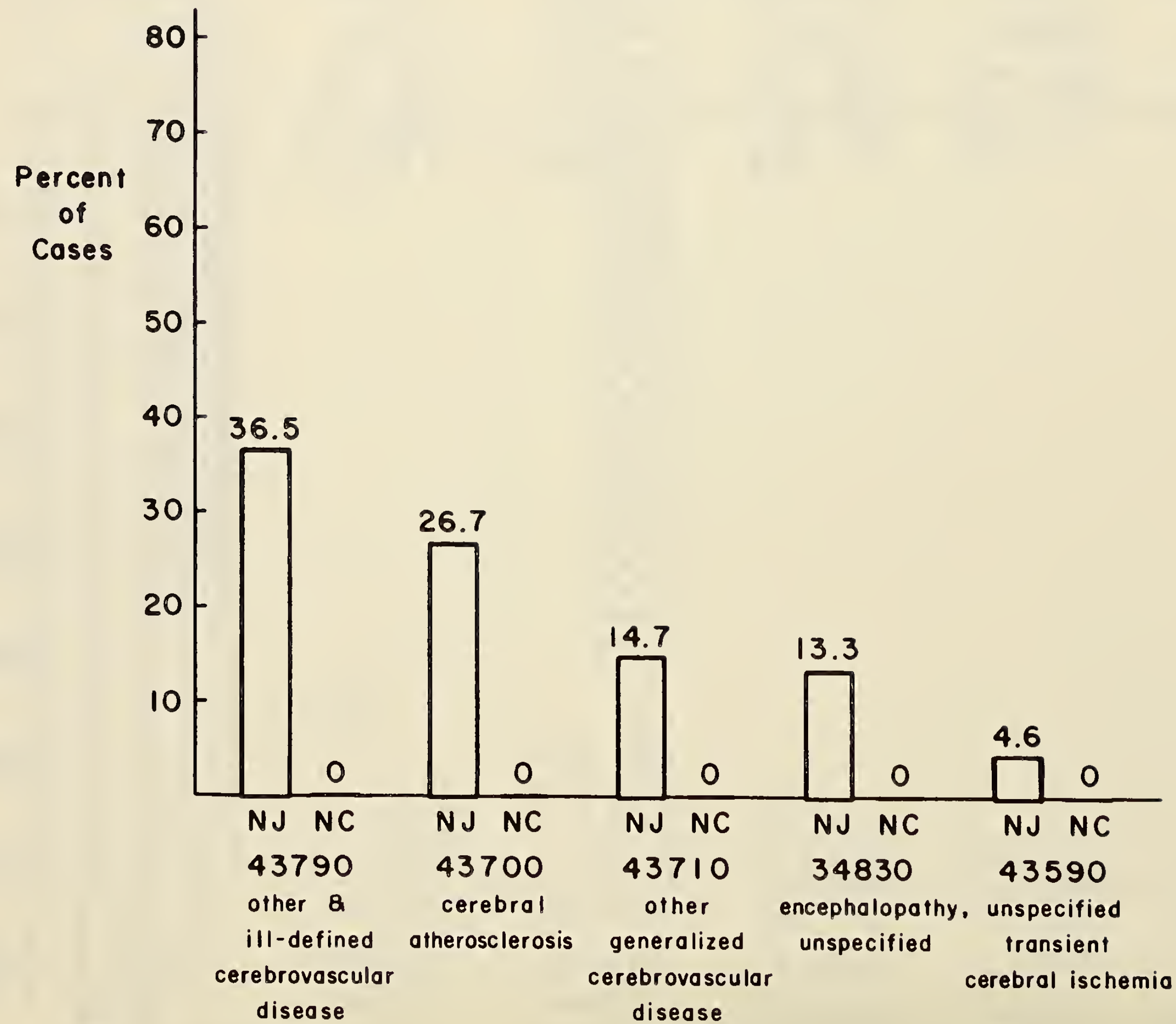
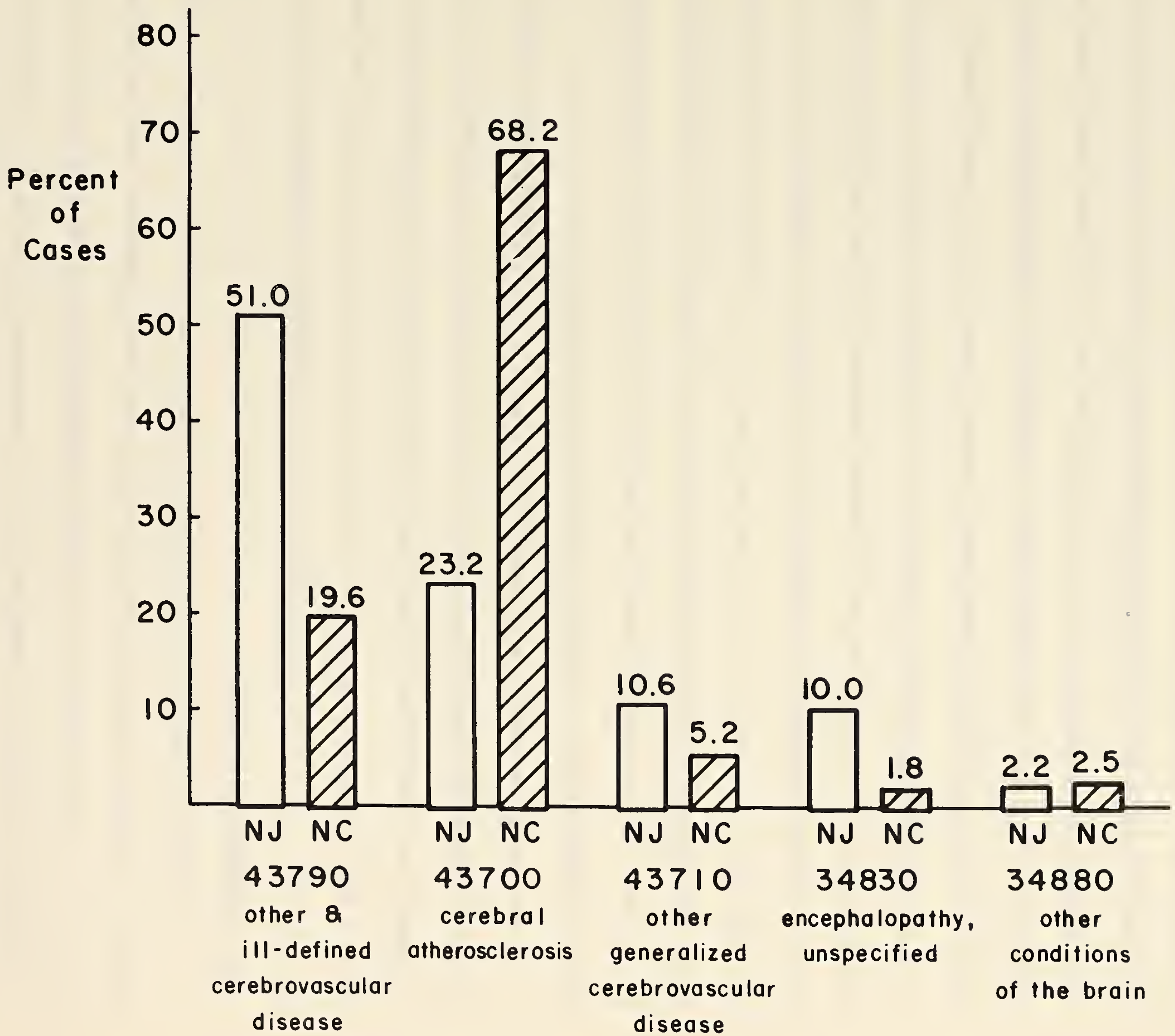


Figure 3.1C[a]
Five Most Common ICD Diagnoses
in DRG 16



[a] The data for North Carolina do not include secondary diagnosis. Therefore, no North Carolina cases were assigned to DRG 16.

Figure 3.1D
Five Most Common ICD Diagnoses
in DRG 17



does not affect DRG assignment, it may suggest differences in data quality in the two states as well as the ability to classify a patient in one of several DRGs.

The major clinical concern in these four DRGs is one inherent in the ICD system itself: although a group of patients may have similar disease from a pathologic standpoint (arterial blockage), the etiology of the blockage and the clinical consequences may be quite different. Two major etiologies are recognized: embolic and thrombotic. In the first, small clumps of material (emboli) floating in the bloodstream become lodged in the blood vessel; onset of these strokes is usually sudden. In the second, thrombus in the vessel (for example, an atherosclerotic plaque) becomes thicker and thicker until it finally prevents blood flow; onset of these strokes is usually slow or "stuttering." However, it is often difficult for a clinician to differentiate these strokes based upon history alone. This determination may be quite important: these two different types of strokes may require very different types of work-up and treatment (see discussion below).

In summary, each of the CVD DRGs contains a number of clinical entities, each of which may demand different clinical approaches and resource consumption. These factors may well contribute to variation both within Part A and B costs. In this case, ICD codes representing similar pathologic processes do not yield homogeneous, clinically coherent groups.

3.3 SEVERITY OF ILLNESS

Severity of illness is a critically important issue in the area of CVD. Broadly defined, cerebrovascular disease includes patients with asymptomatic plaques in their cerebral vessels and stroke patients with profound deficits, compromising functions from mentation to movement. Obviously these patients require very different treatment approaches and incur very different costs. For example, DRG 14 encompasses stroke patients. Included under this DRG could be a patient with a stroke localized to his brainstem (the area of the brain entrusted with maintaining breathing). This patient would require an intensive care setting to allow attachment to a respirator. Long-term use of a respirator results in multiple complications, requiring additional resource use, and it is unlikely that the patient would ever again breath on his own. Also included under this DRG could be a patient with a stroke in a small area of his brain, manifest clinically only by tingling of his fingers on one hand. In certain instances, this type of patient need never be admitted to the hospital. Even if he were admitted, it would be to a general medical floor, and the major activity would be merely watching the patient carefully, to make sure the stroke area did not increase or that complications did not arise. Few tests would be required.

Depending on their practice setting, individual physicians may have caseloads skewed on the severity continuum. An internist with a younger ambulatory practice will treat more of the asymptomatic or mildly-affected subset, while a geriatrician with a larger nursing home caseload will see the more disabled. Therefore, in the design of a DRG reimbursement system for physicians treating CVD, severity of illness is a very important consideration.

3.4 DISCRETIONARY USE OF RESOURCES

The field of CVD is one in which careful histories and physical exams are paramount in formulation of differential diagnoses and treatment plans. However, it is also an area in which the recent burgeoning of imaging technology (e.g., CT scanners) has perhaps caused a substitution of technological inputs for clinical skills. In this case, a specialist (i.e., neuroradiologist) may be required to interpret the scan. But once the diagnostic work-up is complete, most uncomplicated CVD can probably be managed by a general medical doctor.

An important discretionary resource is the consultation. In the field of CVD, the most appropriate medical consultant is the neurologist. Neurologists receive specialized training in diseases of the nervous system, including detailed study of the functional areas of the brain. Skilled neurologists can describe a patient's deficit, and from that knowledge suggest the area of the brain involved. Because of these specialized cognitive skills, a neurologist may be helpful in elucidating the history and uncovering subtleties on physical examination. In certain settings, a neurologist may feel so comfortable with his clinical assessment that he may not feel the need for additional technological evaluation. However, in other settings (e.g., tertiary care settings), the neurologist may be aware of the newest technologic advances (e.g., digital subtraction angiography) and order tests a generalist would not contemplate. In addition, the neurologist may be more informed on appropriate therapies. If a surgical approach is advocated, obviously a neurosurgeon or vascular surgeon must be consulted.

Additional consultations may be required on an individual basis. If patients have atherosclerotic disease in their brains, they may well have significant similar disease elsewhere in their bodies. For example, a cardiologist may be asked to evaluate coronary arteries blocked by atherosclerotic plaques.

The use of discretionary diagnostic technologies with their concomitant physician costs may depend upon the anticipated treatment approach -- medical versus surgical. The major medical question is whether or not to anticoagulate the patient (i.e., administer a drug to prevent blood clots). Anticoagulation is contraindicated if the stroke has involved bleeding into the brain. Thus a physician might perform a lumbar puncture to look for blood in the fluid bathing the brain; a CT scan may also show areas of bleeding (although this test is not 100% sensitive). Most physicians support anticoagulation only in embolic strokes, not thrombotic ones. However, it may sometimes be difficult to obtain the classic history -- sudden onset for embolic, stuttering onset for thrombotic. Some physicians would advocate an angiogram to differentiate the two processes (see below), but this is extremely controversial. Often embolic strokes or TIAs requiring anticoagulation stem from cardiac disease -- a diseased heart releasing small clots (emboli) into the bloodstream which then lodge in vessels in the brain. In this case a cardiologist may be called to perform an echocardiogram or administer a Holter monitor. Thus a wide range of diagnostic activity can be pursued if a medical approach is advocated.

If a surgical approach is planned (i.e., removing the blockage or a potential blockage from the vessel), additional testing focuses on defining anatomy.[23] One standard initial examination is non-invasive investigation of arteries in the neck using a Doppler technique. These studies suggest the degree of vessel narrowing and thus compromise of blood flow. However, disagreement remains as to what degree of narrowing constitutes a significant lesion, and some neurologists feel non-invasive testing is valueless. Before surgery, most agree that an angiogram must be performed. This test, which involves injecting radio-opaque dye into the patient's cerebral vessels and taking x-rays of the patient's head, further defines the anatomy and suggests whether the patient's lesions are operable. Angiography is expensive and carries its own risk of stroke or death (generally quoted at 1.5%). Also physicians disagree about the significance of many of the findings; a major problem is that frequently disease is found in asymptomatic vessels. Should these seemingly incidental findings be treated? Thus, although the costs of

23 Although surgery reassigns the patient to DRG 5, work-up for the appropriateness of surgery may well take place during a medical admission.

angiography are relatively high, the total scope of its benefits remain controversial.

The decision to use one final type of discretionary resource generally occurs after the acute diagnostic and therapeutic choices have been made. This resource is rehabilitative services. Many acute care hospitals now provide these services during acute care stays. A plethora of medical specialists may be involved in assessing the patient and recommending a rehabilitation plan. Neurologists, geriatricians, physiatrists (physicians specializing in rehabilitation medicine), and neuropsychiatrists may participate in this planning, as well as the patient's own primary care physician. Such careful planning may ultimately enhance the quality of a stroke victim's life. However, the multiple physician consultations and the ensuing program may be quite expensive. There are as yet no guidelines relating to appropriate lengths of stays for rehabilitation. Use of this specialized resource is therefore very much up to the discretion of the physician.

In summary, the extent and cost of diagnostic work-up may vary considerably. From the Part B perspective, use of consultants is very costly. But the implications of consultant use remain unknown. For example, will a neurologist substitute cognitive skills for technologic inputs and thus save the system money? Or will a neurologist prompt use of the latest, most expensive diagnostic tools? Technologic inputs may also be very physician costly, although some tests may be more physician intensive than others. For example, physician charges probably account for the majority of lumbar puncture costs but relatively little of CT scan cost. Thus the diagnostic approach may have major resource implications and may account for a portion of the variability in DRG costs.

3.5 DIFFERENCES IN THERAPEUTIC APPROACH

Because of inadequate data on comparison of the different forms of treatment, therapeutic choices remain controversial in CVD. As with diagnostic procedures, one can separate this question into medical and surgical issues.

The major medical choice is whether or not to anticoagulate the patient (i.e., give him medicine to prevent blood clots).[24] Although many physicians will automatically anticoagulate a patient with an embolic stroke, this is debated; in the area of thrombotic strokes the issue is even less clear. If the decision is made to anticoagulate the patient this automatically ensures an additional seven to ten days of hospitalization (that is the amount of time required to switch from the intravenous anticoagulant heparin to the oral preparation warfarin sodium). The length of time to keep the patient on the warfarin is also controversial. This is important because the morbidity associated with anticoagulation in the elderly is significant; for example, the patient may experience excessive bleeding from his gastrointestinal tract or may bleed into his brain after a fall. These sequelae of anticoagulation can therefore be quite serious and costly.

The surgical versus medical treatment issue is also clouded by lack of appropriate data. The only prospective randomized study comparing long-term benefits of the two treatment modalities is now over twenty years old. That study looked at 4,748 patients treated either medically or with carotid endarterectomy; no overall difference in the treatments was found if the surgical mortality and morbidity of 8% were taken into account. However, if

24 In this discussion, the term "anticoagulation" is used synonymously with the administration of warfarin sodium (Coumadin). Warfarin is the more powerful anticoagulant, although an ambulatory regimen of aspirin and Persantine may be prescribed if the risks of warfarin are too great. The differential value of the two regimens is controversial.

the results are broken down for particular classes of patients, significant differences begin to appear. For example, surgical treatment benefited patients with TIAs, mild neurologic deficits, and disease in only one of the two carotid arteries. However, medical treatment was better for patients with more profound deficits and disease in both arteries.[25] Therefore, surgery is only considered appropriate for patients who are otherwise generally healthy and have TIAs or mild strokes.

These limited criteria leave a large group of patients for which choice of therapy is unclear. The most controversial groups are patients with asymptomatic disease, an evolving stroke, or patients being prepared for major surgery (e.g., cardiac surgery). For the first group -- patients with asymptomatic disease -- the goal of surgery would be to prevent future stroke. Given the contradictory reports in the medical literature, there is no consensus on treatment of these patients. The rational for treating the second group -- patients with evolving stroke -- is that if the blockage in the artery can be removed and blood flow restored, the neurologic damage would be minimized. Conclusive proof for this hypothesis remains elusive. Even if the decision to operate is made, the question remains: when? Some physicians recommend surgery within twelve hours of onset of stroke; others recommend stabilizing patients for at least two weeks. The final group of patients -- those undergoing major cardiac or vascular surgery -- are particularly difficult because they obviously have disease elsewhere in their bodies. The impetus behind treating these patients is that during the major surgery transient low blood pressure may compromise even further blood flow through diseased cerebral vessels, thus causing a stroke. Once again, evidence for the benefit of this approach is contradictory.

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25 John A. Byer and J. Donald Easton, "Therapy of Ischemic Cerebrovascular Disease," Annals of Internal Medicine 93 (1980): 748.

In summary, significant differences in clinical approaches remain in the treatment of patients with CVD. Different physicians could treat the same patient very differently, and still be well within the range of acceptable clinical standards. The importance for the reimbursement system is that the differences in therapy have major cost implications. Physicians who advocate an aggressive surgical approach will incur dramatically different costs than those pursuing the most conservative medical therapies.

3.6 STATE DATA[26]

The preceding discussion highlighted two major clinical concerns which could account for a portion of the observed variability in DRG 14 and 15 costs (see Table 3.1). The first is that severity of illness is not incorporated into the DRG rubric. The second is that a number of controversies remain in the treatment of CVD; some of the contested therapies may have significantly different resource implications. The available Medicare data set unfortunately does not allow full study of either problem. Furthermore, given the limitations of the ICD codes upon which these DRGs are based, it is unlikely that a simple clinical split of the DRGs will improve their performance.[27] The problem of differences in therapeutic approach also cannot be rectified by an easy DRG modification.

Therefore, the following state data presentation will consist of a descriptive overview of two topics which must be considered in the design of a physician reimbursement system:

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26 This section will focus only on DRGs 14 ("stroke") and 15 (TIA), because they were created to be clinically homogeneous. By encompassing multiple clinical entities, nonspecific DRGs 16 and 17 do not lend themselves easily to comprehensive clinical analysis.

27 See Chapter 8 on diabetes mellitus. The diabetes ICD codes make a conscious effort to code specific conditions which make diabetes mellitus more severe. Thus, it was relatively easy to make a gross split along severity lines using the ICD codes. The CVD codes are mainly anatomic and bear little relationship to severity of illness.

1. The differential physician costs of teaching versus non-teaching hospital settings;[28] and

2. The impact of specialty of attending physician on costs.

The issues are generic to all DRGs.

3.6.1 Teaching Status

Mean per patient costs are significantly higher in New Jersey than in North Carolina (see Table 3.2). A number of factors probably contribute to this difference, among them the higher rate of admission to teaching institutions of New Jersey cases. As shown in Table 3.3, only 19% of North Carolina DRG 14 cases are cared for in teaching hospitals, whereas 37% of New Jersey cases are. A similar differential exists for DRG 15. Of the $345 difference in New Jersey and North Carolina Part B costs for DRG 14, $171 can be accounted for by the difference in teaching/non-teaching hospital admission rates. Of the $232 difference for DRG 15, only $29 can be attributed to these different admission rates.

TABLE 3.2

MEAN PART A AND B COSTS FOR DRGS 14 AND 15

	DRG 14		DRG 15	
State[a]	Part A	Part B	Part A	Part B
New Jersey	$3,832	$763	$1,947	$575
North Carolina	$2,500	$418	$1,368	$343

a New Jersey and North Carolina mean costs in all four columns are statistically significantly different at the $p<.001$ level.

28 For purposes of this analysis, "teaching hospitals" include both medical school affiliated hospitals and Council of Teaching Hospitals institutions.

TABLE 3.3

NUMBER (PERCENT) OF CASES IN TEACHING

VERUS NON-TEACHING HOSPITALS

Teaching Status	DRG 14 New Jersey	DRG 14 North Carolina	DRG 15 New Jersey	DRG 15 North Carolina
Teaching	3,120 (37%)	1,346 (19%)	1,748 (31%)	497 (18%)
Non-Teaching	5,290 (63%)	5,675 (81%)	3,886 (69%)	2,270 (82%)

As expected, average costs are significantly greater in teaching than in non-teaching hospitals (see Tables 3.4 and 3.5). In New Jersey, Part B cost differences were statistically significant -- $44 in DRG 14 and $33 in DRG 15 (6% higher for both). In North Carolina, the Part B teaching versus non-teaching differences were actually greater -- $146 in DRG 14 and $223 in DRG 15. This translates into a 37% higher cost in DRG 14 and a 74% higher cost for DRG 15. Thus, it appears that admission to a teaching hospital has more of an impact on costs in North Carolina than in New Jersey.

What relationship does length of stay (LOS) have to physician costs (LOS information is also in Tables 3.4 and 3.5)? In DRG 14, LOS is significantly longer in teaching than non-teaching hospitals -- 1.59 days in New Jersey and 1.11 days in North Carolina. It is possible that the $44 extra in New Jersey Part B cost could be accounted for on the basis of 1.59 days' daily visit fee alone (assuming, for example, a $30 daily visit fee). But it is unlikely that the 1.11 extra days in North Carolina could explain the $146 extra cost. Different physician inputs must be used in the North Carolina teaching setting.

TABLE 3.4

LENGTH OF STAY, PART A AND B COST BY TEACHING

STATUS OF HOSPITAL FOR DRG 14

Variable and Teaching Status	New Jersey Mean	New Jersey t-Test[a]	North Carolina Mean	North Carolina t-Test[a]
Length of Stay (Days)				
Teaching	19.99	t=3.74	17.32	t=2.33
Non-Teaching	18.40	p<.001	16.21	p<.02
Part A Costs				
Teaching	$4,260	t=7.43	$3,706	t=12.32
Non-Teaching	$3,593	p<.001	$2,248	p<.001
Part B Costs				
Teaching	$792	t=3.47	$536	t=10.63
Non-Teaching	$748	p<.001	$390	p<.001

a Means of teaching and non-teaching institutions within states were compared by t-test.

TABLE 3.5

LENGTH OF STAY, PART A AND B COST BY TEACHING

STATUS OF HOSPITAL FOR DRG 15

Variable and Teaching Status	New Jersey Mean	New Jersey t-Test	North Carolina Mean	North Carolina t-Test
Length of Stay (Days)				
Teaching	10.84	t=0.1320	8.40	t=2.17
Non-Teaching	10.87	N.S.	7.68	p<.03
Part A Costs				
Teaching	$2,078	t=3.52	$2,121	t=9.41
Non-Teaching	$1,896	p<.001	$1,213	p<.001
Part B Costs				
Teaching	$598	t=2.84	$526	t=8.26
Non-Teaching	$565	p<.005	$303	p<.001

DRG 15 has even closer LOSs between teaching and non-teaching hospitals. In New Jersey, the two have virtually identical LOS. In North Carolina, the difference is only 0.72 days; this small time period cannot account alone for the extra $223 in the teaching setting. As in DRG 14, North Carolina TIA patients hospitalized in a teaching facility must be receiving more costly physician services than their counterparts in non-teaching institutions. However, since the lengths of stay are almost the same, it is difficult to argue that patients in one institution are more severely ill than in the other.

To explore further the possibility of caseloads of very different severity, an outlier analysis was performed. Outlier parameters were calculated twice: once on the basis of LOS; once on the joint basis of Part A and B costs. Outliers are defined as those above three standard deviations from the geometric mean (see Table 3.6). The analysis was geared toward clarifying the following issues:

1. Where are most of the outliers? If teaching hospitals are truly treating more serious cases, they should supply a disproportionate share of the outlier load.

TABLE 3.6

OUTLIER CRITERIA

DRG	New Jersey	North Carolina
DRG 14	LOS > 68 days	LOS > 58 days
	Part A > $14,331 Part B > $2,308	Part A > $9,851 Part B > $1,460
DRG 15	LOS > 35 days	LOS > 25 days
	Part A > $6,799 Part B > $1,670	Part A > $5,560 Part B > $1,390

2. Once outliers are removed, will teaching and non-teaching hospitals equilibrate? If teaching hospitals support many outliers, this would skew mean values upwards. By removing outliers, teaching and non-teaching hospital values should be similar if they are providing the same "product."

The results of this outlier analysis appear in Tables 3.7, 3.8, and 3.9, and are summarized below:

1. New Jersey. For DRG 14, 2.7% of teaching and 2.1% of non-teaching hospital cases were LOS outliers. For DRG 15, 2.2% of teaching and 2.3% of non-teaching hospital cases were LOS outliers.

2. North Carolina. For DRG 14, 2.6% of teaching and 2.0% of non-teaching hospital cases were LOS outliers. For DRG 15, 3.6% of teaching and 1.9% of non-teaching hospital cases were LOS outliers.

3. For both states in both DRGs, removing outliers brings LOS closer for teaching and non-teaching hospitals. In DRG 15 the differences are no longer significant in either state.

4. In both states as expected, a higher percent of teaching hospital cases were cost outliers. This is more apparent in North Carolina than in New Jersey.

5. Removing cost outliers did not cause a rapprochement between teaching and non-teaching hospital costs. Mean costs continue to be significantly different at the $p<.001$ level in both states and both DRGs. However, in terms of dollars, Part B costs moved slightly closer. In New Jersey, teaching hospital Part B costs were $32 higher in DRG 14 and $29 higher in DRG 15. In North Carolina, teaching hospital Part B costs were $90 higher in DRG 14 and $144 higher in DRG 15.

In summary, teaching hospital physician costs are greater than non-teaching hospital physician costs in both states. But in North Carolina the difference is striking; it cannot be attributed solely to a slightly longer LOS. In North Carolina the cost difference suggests that physicians in teaching hospitals practice differently or use different physician inputs than those in non-teaching hospitals. In New Jersey, the small cost difference could be due to an extra daily visit fee. It is not apparent from cost data alone that New Jersey physicians in the two setting behave very differently.

If LOS outlier status serves as a gross proxy for overall severity of illness, it also does not always appear that teaching hospitals have a

TABLE 3.7

NUMBER (PERCENT) OF CASES WITHIN EACH HOSPITAL

TYPE DELETED BY OUTLIER CUT-OFF

		NEW JERSEY		NORTH CAROLINA	
Outliers Based Upon:		Teaching	Non-Teaching	Teaching	Non-Teaching
DRG 14:	Length of Stay	84 (2.7%)	110 (2.1%)	35 (2.6%)	115 (2.0%)
DRG 14:	Part A and B Costs	138 (4.4%)	170 (3.2%)	117 (8.7%)	119 (2.1%)
DRG 15:	Length of Stay	38 (2.2%)	89 (2.3%)	18 (3.6%)	44 (1.9%)
DRG 15:	Part A and B Costs	68 (3.9%)	121 (3.1%)	38 (7.6%)	36 (1.6%)

TABLE 3.8

LENGTH OF STAY, PART A AND B COST BY TEACHING STATUS OF HOSPITAL: OUTLIERS REMOVED[a] FOR DRG 14

	New Jersey		North Carolina	
Variable and Teaching Status	Mean	t-Test	Mean	t-Test
Length of Stay (Days)				
Teaching	17.75	t=3.61	15.72	t=2.55
Non-Teaching	16.69	p<.001	14.80	p<.05
Part A Costs				
Teaching	$3,672	t=8.27	$2,853	t=12.12
Non-Teaching	$3,181	p<.001	$2,106	p<.001
Part B Costs				
Teaching	$726	t=3.33	$450	t=10.23
Non-Teaching	$694	p<.001	$360	p<.001

a Outliers are defined as cases above three standard deviations from the geometric mean. Outliers were determined separately for length of stay and Part A and B costs (see Tables 3.6 and 3.7).

TABLE 3.9

LENGTH OF STAY, PART A AND B COST BY TEACHING STATUS

OF HOSPITAL: OUTLIERS REMOVED FOR DRG 15

	New Jersey		North Carolina	
Variable and Teaching Status	Mean	t-Test	Mean	t-Test
Length of Stay (Days)				
Teaching	9.87	t=0.46	7.43	t=1.77
Non-Teaching	9.95	N.S.	7.07	N.S.
Part A Costs				
Teaching	$1,842	t=4.86	$1,717	t=11.54
Non-Teaching	$1,687	p<.001	$1,103	p<.001
Part B Costs				
Teaching	$554	t=3.29	$428	t=11.78
Non-Teaching	$525	p<.001	$284	p<.001

disproportionate share of the sickest patients. Therefore, the higher physician costs can also not be attributed to more severely ill patients in the teaching setting alone.

3.6.2 Specialty of Attending Physician

New Jersey patients are more likely than North Carolina patients to have a specialist as their attending physician (see Table 3.10). Among patients who do have specialists as their attending physician, the states differ somewhat in the type of specialist. In New Jersey, 7.8% of DRG 14 and 8.0% of DRG 15 patients are followed by cardiologists; comparable percentages in North Carolina are 1.4% and 1.5%. However, in North Carolina more patients are followed by neurologists -- 9.1% in DRG 14 and 8.1% in DRG 15 -- compared to New Jersey -- 6.5% in DRG 14 and 4.2% in DRG 15. Although more New Jersey patients have specialist attendings, they are also more likely than their North Carolina counterparts to obtain specialist consultations (see Figure 3.2).

As expected, specialists incur significantly higher Part B costs than general and family practitioners (see Table 3.11). However, different specialties often have different costs. These differences are more apparent in New Jersey than North Carolina. Dealing with New Jersey first, cardiologists and internists have similar costs in both DRG 14 and 15.[29] In DRG 14, neurologists also had comparable Part B costs.[30] But in DRG 15, neurologists had significantly higher costs than cardiologists and internists (at the $p<.01$ level).

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29 Statistical comparisons of cardiology and internal medicine means yielded t=1.26 (N.S.) for DRG 14 and t=0.51 (N.S.) for DRG 15.

30 Statistical comparison of neurology and internal medicine means yielded t=0.19 (N.S.) and neurology and cardiology means produced t=0.85 (N.S.).

TABLE 3.10

SPECIALTY OF ATTENDING PHYSICIAN

(PERCENT OF CASES)

Specialty	DRG 14[a] New Jersey (N=8410)	DRG 14[a] North Carolina (N=7021)	DRG 15[b] New Jersey (N=5634)	DRG 15[b] North Carolina (N=2767)
General/Family Practice	20.8	37.6	21.8	36.4
Internal Medicine	53.5	45.1	55.3	45.4
Cardiology	7.8	1.4	8.0	1.5
Neurology	6.5	9.1	4.2	8.1
Neurosurgery	1.1	1.9	0.7	2.7
Other	10.3	4.9	10.0	5.9
	100.0	100.0	100.0	100.0

a Chi-square comparing New Jersey and North Carolina data yielded x^2=881.3, p<.001.

b Chi-square comparing New Jersey and North Carolina data yielded x^2=465.7, p<.001.

TABLE 3.11

MEAN PART A AND B COSTS BY SPECIALTY OF ATTENDING

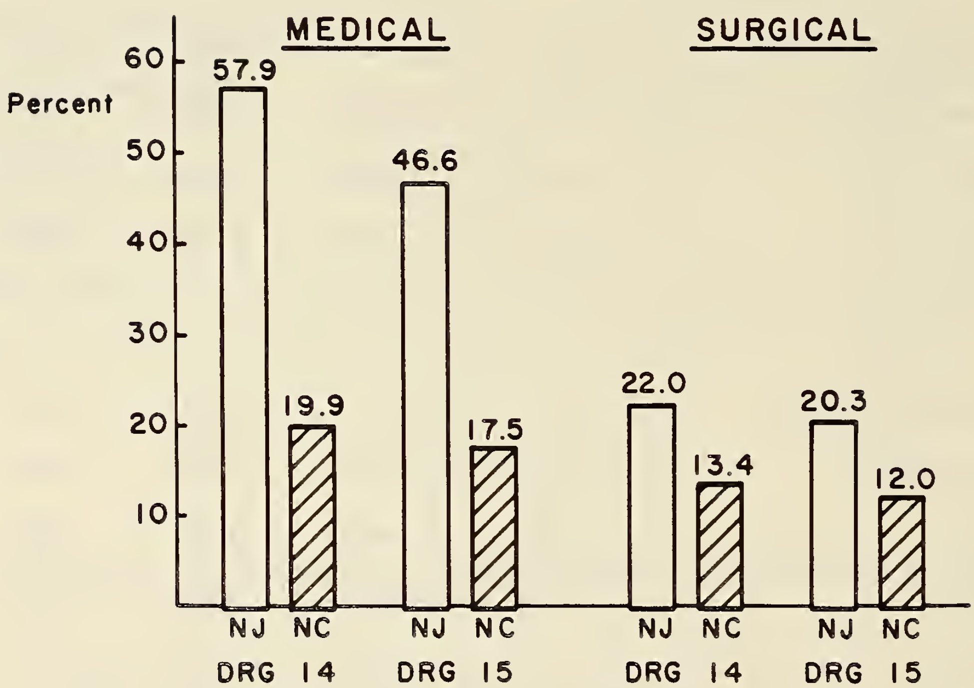
PHYSICIANS: DRGS 14 AND 15

DRG Number and Specialty Name	PART A COSTS New Jersey	PART A COSTS North Carolina	PART B COSTS New Jersey	PART B COSTS North Carolina
DRG 14				
General/Family Practice	$3,611	$2,162	$664	$313
Internal Medicine	$3,824	$2,569[a]	$784[a]	$444[a]
Cardiology	$4,056[b]	$3,182[a]	$822[a]	$547[a]
Neurology	$3,720	$3,580[a]	$790[a]	$632[a]
DRG 15				
General/Family Practice	$1,851	$1,171	$492	$228
Internal Medicine	$1,992[b]	$1,380[a]	$597[a]	$356[a]
Cardiology	$1,952	$1,947[a]	$584[a]	$595[a]
Neurology	$1,910	$2,053[a]	$692[a]	$613[a]

a Significantly different from general/family practice costs at the .001 level.

b Significantly different from general/family practice costs at the .05 level.

Figure 3.2
Percent of Patients Receiving
Medical and Surgical Consultations
CEREBROVASCULAR DRGs



In North Carolina, all comparisons of mean Part B costs (internists versus cardiologists versus neurologists) yielded statistically significant results. Most striking is the difference between mean internist and mean neurologist costs. Neurologists are much more expensive -- by $188 for DRG 14 and $257 for DRG 15.[31]

Thus, it appears that in New Jersey specialty of attending physician has relatively less influence on cost than in North Carolina, where different specialties incur signficantly different costs. While New Jersey internists, cardiologists and neurologists may practice differently, they all generally cost roughly the same. In North Carolina, interspecialty practices and costs probably differ. These regional differences may be important in considering specialist payment under a prospective reimbursement system.

3.7 IMPLICATIONS OF PROSPECTIVE REIMBURSEMENT FOR PHYSICIAN BEHAVIOR

As discussed in the previous sections, the area of cerebrovascular disease raises some interesting and complicated issues. First, there is little consensus on therapeutic approach. Second, there is only slightly more consensus on diagnostic approach. Third, some of the major diagnostic and therapeutic technologies (e.g., angiography, anticoagulation, endarterectomy) have significant morbidity and even mortality attached to them. Thus, the physician is confronted with a common illness for which there is no common and predictably safe approach. In view of this complexity and the severity of the morbidity associated with the various diagnostic and treatment options, the conscientious physician will make his decisions based on many clinical variables and his past experience. The complication of brain death is too onerous for most physicians to risk lightly. How would altering the reimbursement process affect physician behavior? Could changed financial

31 Statistical comparisons of neurology and internal medicine means yielded $t=10.88$ ($p<.001$) for DRG 14 and $t=6.10$ ($p<.001$) for DRG 15.

incentives sway physician choices? These questions must be answered in several different spheres.

For Part B one of the most important areas is the use of consultations. The conventional wisdom is that consultations incur costs: not only the specialist's fees but also the charges for the additional testing he suggests. This may very well be the case in CVD, with neurologists ordering sophisticated radiologic procedures or diagnostic studies. However, in certain settings, a neurologic consultation may actually save money. For example, a general practitioner admits a patient to a community hospital. He is unsure from history and physical exam of the etiology of the patient's problem so he orders a CT scan. A neurologist who sees multiple stroke patients also sees the patient. He elicits additional history and feels so comfortable with his clinical assessment that he does not require a CT scan. The fee for the neurologist is far less in this case than the cost of the uncertainty of the generalist.

Therefore, the issue of consultations is not itself clear. If the structure of a DRG reimbursement system yielded disincentives to obtaining neurologic consultation, the system and patients may suffer, both from a cost and quality perspective. Two additional concerns are the surgical and rehabilitation consultations. Few patients enter the hospital in the primary care of a surgeon. The surgeon is called only if that treatment approach is considered. Since the medical versus surgical therapeutic choice is controversial, the incentive to obtain a surgical consultation might be lessened if the reimbursement structure forced fee sharing. An alternative approach would be to split admissions. The general medical doctor would furnish routine care on the first hospitalization with the surgeon assuming that role for the second.

The rehabilitation consultation is also very important from a quality and cost vantage. The goal of rehabilitative services is to improve the functional level of the patient. His quality of life would be similarly enhanced. However, the service may be expensive; several consultants from different specialties may be involved. Because of this, a physician may choose to defer rehabilitation evaluation until after discharge. An alternative strategy would be to transfer the patient directly from an acute care setting to a rehabilitation hospital. Thus costs would be shifted to a location currently exempted from the purview of the prospective payment system.

The choice of medical treatment -- anticoagulation (with warfarin) versus no anticoagulation (or treatment with aspirin and Persantine) -- has both Part A and Part B implications. As mentioned earlier, the decision to anticoagulate automatically guarantees an extra week of hospitalization. Since the role of anticoagulation itself is controversial, physicians may be swayed in cases which they consider equivocal. If the level of DRG reimbursement does not compensate them for what they consider the added costs of following a patient on anticoagulants, they may not adopt this mode of treatment unless they believe it is clearly indicated.

Similarly, the issue of surgery also has hospital and physician costs. As mentioned in the clinical approaches section, surgery is indicated in only a small subset of CVD patients. Even in these cases, the risks of the morbidity and mortality of the angiogram plus surgery may exactly equal the benefit of the surgery. The surgical risks vary in different institutions; the medical literature contains reports from 0 to 23% morbidity and mortality.[32] Institutions which fare poorly may find the DRG system offers

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32 Byer and Easton, p. 749. The high levels of complications are beyond what many physicians consider justifiable from a severity of illness perspective.

them incentives to curtail these services (a DRG payment for a given operation may not be sufficient for the aftercare of a patient harmed by the surgery). This may be contrary to the wishes of the surgeons at that institution, for whom aftercare costs may represent a small fraction of their surgical fee.

Split admissions is an area in which both the hospital and the physicians may have the same incentives under a DRG system. Working in parallel, these incentives could encourage increased use of this costly practice. For example, an internist admits a patient with a mild completed stroke. Given the patient's characteristics, he is considered a good surgical candidate. Diagnostic work-up and surgery could be performed during the same admission. But it would also be appropriate to send him home, let him rest and recover, and have the surgeon readmit him for the operation. If the indication for surgery is an evolving stroke, the medical literature itself is contradictory; some recommend surgery within twelve hours and others suggest waiting several weeks. Thus, the practice of splitting admissions could be staunchly supported even from a medical standpoint.

Consultations may also be moved from an inpatient to an outpatient setting. For example, if an internist felt a surgical approach was possible but was planning to release the patient prior to surgery, the surgical consultation itself could be obtained as an outpatient. Moving diagnostic work-up from inpatient to outpatient sites may be less of a concern for CVD than for other illnesses. CT scans are usually not "elective" in the sense that a patient can schedule it at his leisure and come back weeks or months later.[33] To yield the necessary information for choice of therapy the scan must be done in the acute period when hospitalization is appropriate. The

33 This discussion focuses on the appropriate use of CT scans in an acute care setting. However, some physicians appear to administer multiple CT scans to their stroke patients in a post-acute setting. This may often be inappropriate.

most costly test, angiography, is safely done only in a hospital setting where back-up resources are available should complications arise. The only test which could be shifted is the non-invasive Doppler exam, and this shift may very well occur. However, since the cost of this test is so much less than for others, the financial impact may be minimal.

An additional concern is one of "DRG creep." Unless a patient receives the full gamut of testing, diagnostic work-up may not in fact pinpoint the exact nature of his disorder (for example, a migraine headache may sometimes present with symptoms similar to a TIA). Therefore, choosing the diagnosis may be a problematic task. Since from a clinical perspective the issue is equivocal, financial concerns may dictate the final decision. Among those DRGs consistent with this somewhat non-specific diagnosis, the most profitable DRG would be chosen.

Finally, CVD clearly raises an issue which is extremely important to physicians and for quality of care. A DRG system would implicitly set norms by looking at current practice and choosing an average reimbursement level. However, CVD is an area in which there is little consensus. Certain articles support one treatment; other articles refute these claims and support another. Is it appropriate to financially penalize modes of care when evidence of their value is conflicting?

3.8 SUMMARY AND CONCLUSIONS

Cerebrovascular disease is largely a disorder of the elderly. It is therefore a class of disease with great significance to the Medicare system, supplying thousands of cases and costing millions of dollars annually. The New Jersey and North Carolina statistics bear this out; the four CVD DRGs are among the largest and costliest in the DRG system. Thus, the variabilty of costs within these DRGs could be very important and may be of concern to those designing the reimbursement system. Part A and Part B CVs for DRGs 14 through 17 are uniformly high. The greatest Part B CV is in North Carolina in the comparatively well-defined DRG 15, Transient Ischemic Attacks (1.0970). Can the clinical perspective suggest the source of this variation?

In these DRGs, the issue of defitional precision is closely tied to the severity of illness. Differences in diagnostic and therapeutic needs based on severity of illness could well account for a portion of the variation. Differences in diagnostic and therapeutic approaches could also contribute variation. Given the absence of consensus in this field, such variation is expected and may be medically quite appropriate. Finally, certain diagnostic and treatment tools have their own risk attached; different institutions have different experiences with these iatrogenic problems. Part of the variability could be explained by differences in quality of care and costs of complications.

The state data analyses focused on two generic issues: the impact of teaching hospital setting and of specialty of attending physician. As expected, teaching hospitals had significantly higher physician costs, but the differences were much greater in North Carolina. In New Jersey, the small cost difference could be due to an extra daily visit fee from a slightly longer stay. But the North Carolina difference was so great it must represent significantly different practice patterns or resource costs. Furthermore, teaching hospitals did not always provide a disproportionate share of length of stay outliers, although the majority of cost outliers came from teaching hospitals. Finally, the differential costs of specialists was much more dramatic in North Carolina.

The clinical perspective can thus elucidate possible sources of variation. However, much of the above discussion failed to separate Part A and Part B implications. This separation is difficult because physician behavior and hospital costs are closely related and because the issues of severity of illness and diagnostic/therapeutic controversy have similar impact on physicians and hospitals. This similarity should be carefully considered in the design of a reimbursement system. The DRG-based PPS for Part A may provide certain perverse incentives for hospitals. If the PPS for physicians created the same perverse incentives, the system could face double vulnerability. Several examples are as follows:

1. Case Mix. Hospitals have an incentive to to admit patients with marginal illness because these "cheap" patients would subsidize the more expensive. Physicians would have the same incentive.

2. Split Admissions. Hospitals have an incentive to release stabilized patients then readmit them for an elective procedure. Physicians would have the same incentive, particularly if a surgeon and general medical doctor would have to split a single DRG fee.

3. Diagnosis/Therapy. Hospitals have an incentive to deliver homogeneous care, at the least expensive medically acceptable level. In CVD the physician incentives are complicated by the controversy surrounding diagnostic and therapeutic approaches. However, in equivocal cases where the approach is unclear, the physician would have the same incentive as the hospital.

4. Work-Up Setting. Hospitals have an incentive to shift expensive tests from an inpatient to an outpatient setting. As discussed in the previous section such shifts may often not be feasible or clinically appropriate for the CVD patient. However, the physician may have the same incentive in selected areas: elective surgical consultation, non-invasive examination of the arteries.

5. Rehabilitation Evaluation Setting. Hospitals have an incentive to shift rehabilitation evaluation and therapy from an inpatient to an outpatient or rehabilitation hospital setting. Physicians would have the same incentive.

6. DRG Creep. Hospitals have an incentive to move patients into the most profitable DRG appropriate. In those cases where the diagnosis is unclear, physicians would have the same incentive.

One can speculate that in certain specific circumstances hospital and physician incentives under an identical PPS may differ.

1. Consultations. In certain hospitals, specialists (i.e., neurologists in CVD) may substitute their clinical skills for more expensive

technologic inputs. In these hospitals, the hospital incentive would be to encourage neurologic consultation. Physicians forced to share their DRG fee would be less likely to call a neurologist. In those institutions where neurologists tend to order technology-intensive testing, hospital and physician incentives may merge.

2. Iatrogenic Complications. Hospitals where the radiologic and surgical experience is problematic may prefer to limit these services rather than pay for the iatrogenic consequences. The physician incentive may be to continue to offer these services.

It is difficult to predict the impact of these perverse incentives, but clearly they should be well understood before a physician PPS is put into place. This investigation should be broadened to address the philosophical point raised at the end of the last section: given the remaining controversy in approaches of care, is it appropriate for a reimbursement system to implicitl set norms? Homogenizing care in this hotly debated field may in the long run affect quality of care by discouraging comparative study which may lead to both improvement and consensus.

Chapter 4

PNEUMONIA: MEDICAL DRGS

DRG 89: Simple Pneumonia and Pleurisy Age > 69 and/or c.c.

DRG 90: Simple Pneumonia and Pleurisy Age 18-69 w/o c.c.

DRG 91: Simple Pneumonia and Pleurisy Age 0-17[34]

4.1 INTRODUCTION

Despite remarkable advances in antibiotic therapy and medical management, pneumonia remains a leading cause of morbidity and mortality worldwide. In the United States, pneumonia and influenza combined rank fifth among the leading causes of death. The elderly population is particularly susceptible to the illness. DRGs 89 and 90 account for 5,612 cases in New Jersey and 6,115 cases in North Carolina. These large caseloads also generate high costs. Together Part A and B expenses for these two DRGs totalled $21,320,383 in New Jersey and $15,708,016 in North Carolina. Nationwide, pneumonia probably costs Medicare over one billion dollars per year.

Although on the surface pneumonia may appear to be a relatively straightforward disease, its clinical presentation may be plagued with complexities. This clinical heterogeneity may translate into cost heterogeneity -- the variation within the pneumonia DRGs is very high (see Table 4.1). As is the pattern with most medical DRGs, Part A variation is consistently higher than Part B variation.

How can this heterogeneity be explained invoking the clinical perspective? The answer may be found along three dimensions:

1. Pneumonia has multiple etiologies, which may represent distinct clinical entities.

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34 The ensuing discussion will focus on DRGs 89 and 90, which are most pertinent to a Medicare population.

2. Each entity can present with a wide range of severities, strongly influenced by comorbid conditions (e.g., underlying malignancy, alcoholism).

3. A large number of discretionary resources may be tapped variably for care of pneumonia patients.

This chapter examines each of these issues, focusing most heavily upon the problems of comorbidity and the range of discretionary resources.

TABLE 4.1

VARIATION WITHIN PNEUMONIA DRGS

	New Jersey		North Carolina	
	DRG 89	DRG 90	DRG 89	DRG 90
Part A CV	1.0150	1.0620	1.1230	1.2540
Part B CV	0.8770	1.0060	0.9190	0.9840

4.2 DEFINITIONAL PRECISION

New Jersey and North Carolina employ virtually identical codes in describing their pneumonia cases (see Figure 4.1). Over three-quarters of cases are assigned the vague description, "Pneumonia, organism unspecified" (Code 48600). An additional 10% receive the similarly non-specific "Bronchopneumonia, organism unspecified" (Code 48500). That this vague coding style is practiced in both states suggests a generic problem in defining pneumonias. The ICD coding system offers an extensive list of diagnostic options, specifying numerous etiologic agents. Why aren't these more precisely defined codes used?

Pneumonia is usually caused by a microbial infection -- by a bacteria (e.g., Pneumococcus, Staphyloccus), by a virus (e.g., influenza, respiratory syncytial virus), by a fungus (e.g., histoplasma, coccidiodes), or by a

Figure 4.1A
Five Most Common ICD Diagnoses
in DRG 89

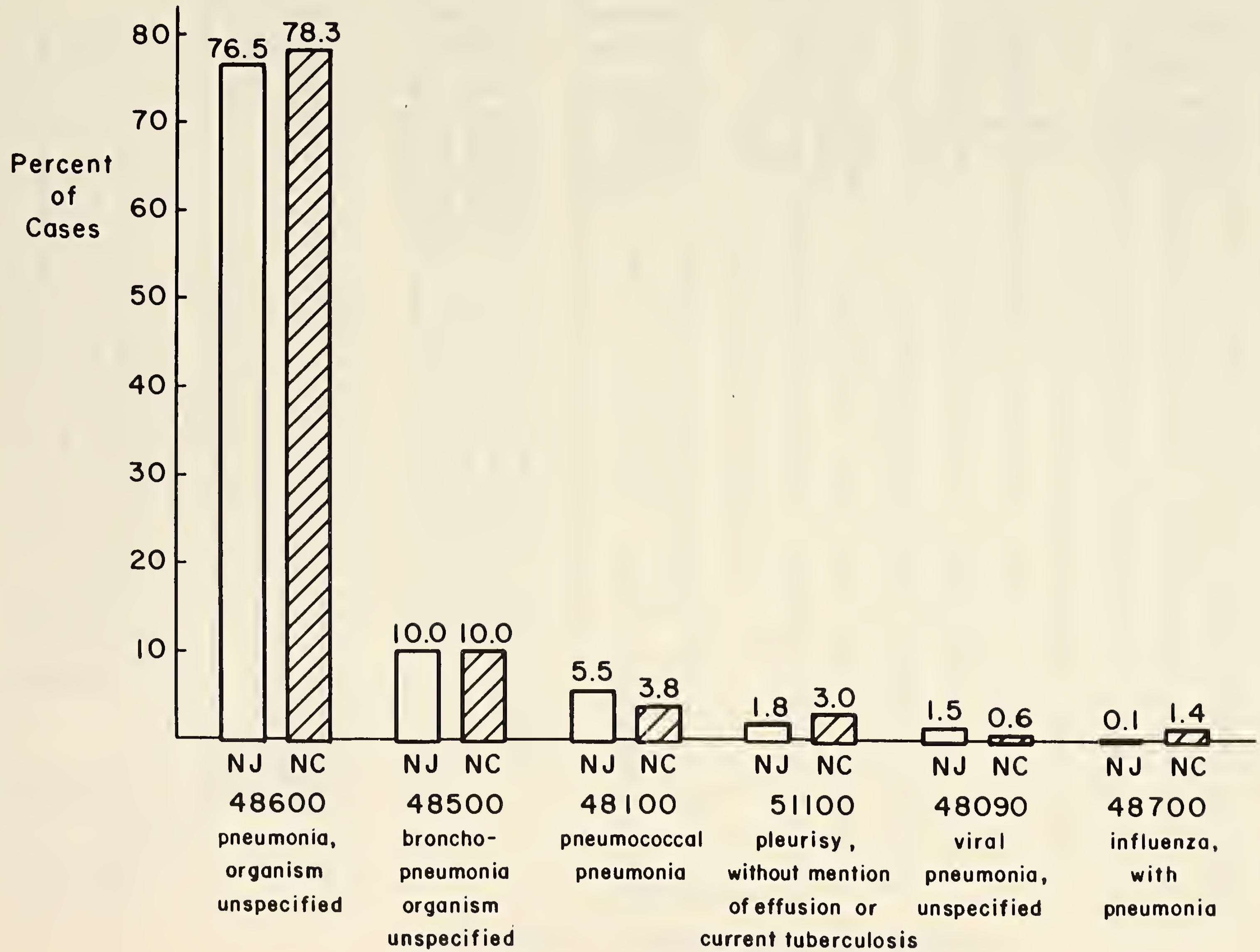
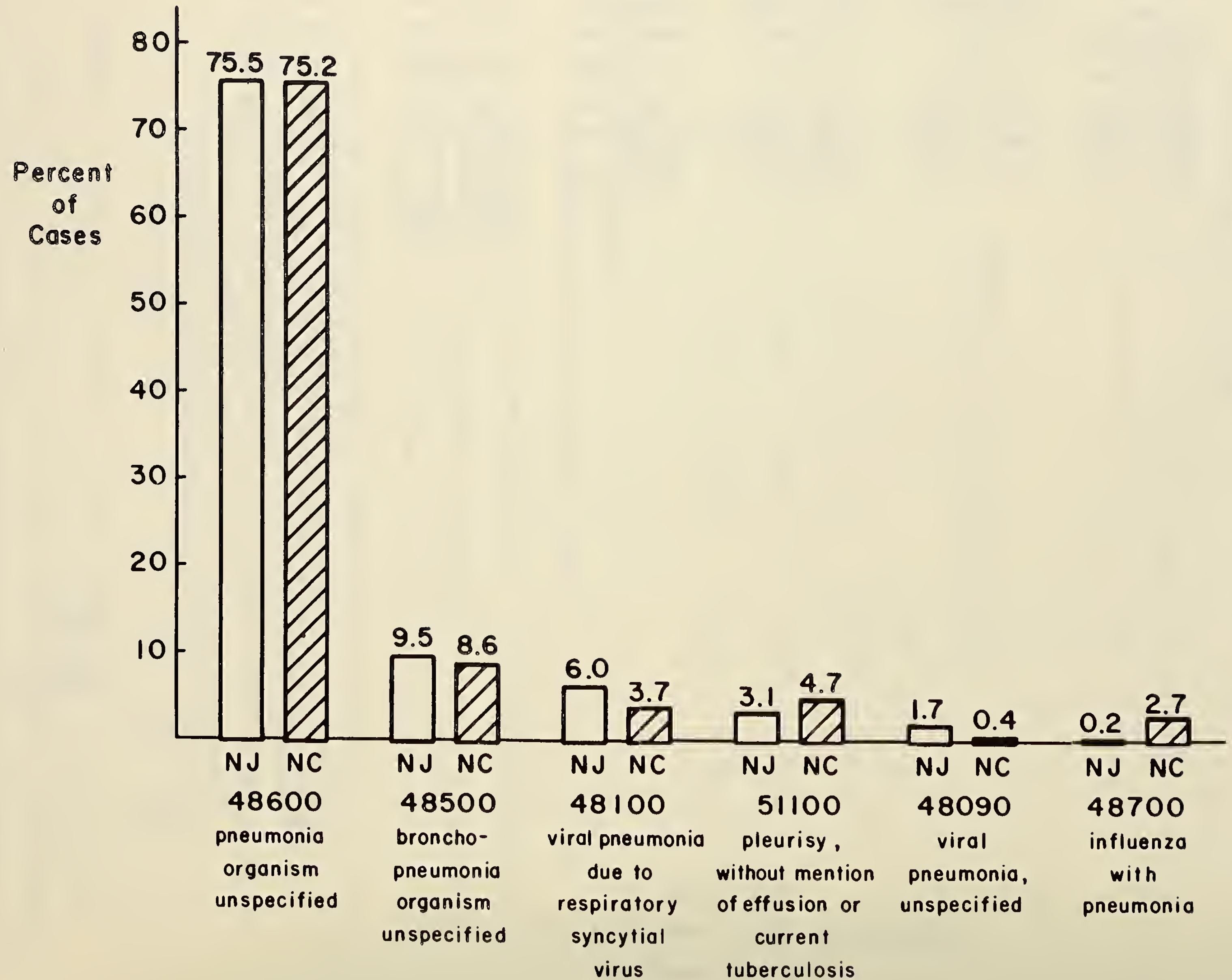


Figure 4.1B
Five Most Common ICD Diagnoses
in DRG 90



protozoan (e.g., Pneumocystis carinii).[35] The various etiologies may have very different clinical presentations. For example, a staphylococcal bacterial pneumonia classically evolves into a serious lung abscess. Other bacteria such as the tuberculosis bacillus may have dramatic systemic effects, as well as a profound respiratory infection. Certain fungal pneumonias (e.g., aspergillosis) are frequently recalcitrant to therapy (anti-fungal medications are highly toxic as well, and are thus usually used only as a last resort). Protozoan pneumonias tend to occur in very debilitated patients; this type of pneumonia generally marks the terminal event in a patient's course. Thus, certain organisms are likely to cause extremely serious and life-threatening diseases. These specific etiologies have been grouped under the "Respiratory Infections and Inflammations" DRGs (79, 80, 81). Their higher costs are reflected in the higher assigned relative weights.[36]

Once these specific etiologies are removed to their own DRGs, the remaining categories are by default rather vague. These vagaries may actually reflect the clinical complexities of diagnosing pneumonia.

> The course of each type of bacterial pneumonia is distinctive. Pneumococcal pneumonia generally responds well to low-dose penicillin...within one to two days after therapy has been initiated... Gram negative [bacterial] pneumonias occur in the setting of underlying disease and debilitation, and more than 50% of patients die.[37]

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35 Non-infectious causes of pneumonia are generally irritants of lung tissue (e.g., chemicals, dusts, aspirates). These pneumonias fall into DRGs 79, 80, and 81.

36 "Rules and Regulations," Federal Register 48 (September 1, 1983): 39876-39886.

DRG 79	Resp Infections and Inflammations Age > 69 and/or c.c.	R.W. 1.7982
DRG 80	Resp Infections and Inflammations Age 18-69 w/o c.c.	R.W. 1.7445
DRG 81	Respiratory Infections and Inflammations Age 0-17	R.W. 0.8743
DRG 89	Simple Pneumonia and Pleurisy Age > 69 and/or c.c.	R.W. 1.1029
DRG 90	Simple Pneumonia and Pleurisy Age 18-69 w/o c.c.	R.W. 0.9849
DRG 91	Simple Pneumonia and Pleurisy Age 0-17	R.W. 0.5131

37 Mark C. Fishman, et al., Medicine, Philadelphia: J.B. Lippincott Company, 1981, p. 397.

However, it is not often so easy to determine the etiology of a pneumonia on clinical course alone. The offending organisms must be positively identified, generally from a patient's sputum. But some patients do not produce sputum or sputum findings are inconclusive. The precise diagnosis thus remains elusive unless invasive testing is performed, such as a transtracheal aspirate or a lung biopsy. Even then, diagnosis is not always clearcut. Treatment is initiated on an empirical basis.

In summary, DRGs 89 and 90 include the less severe forms of specific bacterial pneumonias (e.g., pneumococcal, streptococcal) as well as cases for which the specific infectious agent has not been identified. Such uncertainty is often the case in caring for pneumonia patients. But this uncertainty also predisposes the pneumonia DRGs to considerable variability.

4.3 SEVERITY OF ILLNESS

The spectrum of illness severity in pneumonia is extremely broad. Patients range from those with a "walking pneumonia" requiring oral antibiotics and a few days of rest, to those with a fulminant course ending in respiratory failure and ventilator dependence. Perhaps the most important determinant of pneumonia severity is comorbidity.

Innumerable conditions predispose patients to pneumonia. In fact, pneumonia is frequently the final fatal complication in a large number of diseases; ultimate survival of a pneumonia may be more dependent upon the underlying illness than the intensity of technologies used to combat the pneumonia. Several predisposing factors are particularly prevalent in western society. Very old age is an important consideration, due to impaired immunity in the elderly.[38] Chronic obstructive pulmonary disease (COPD) and emphysema also predispose patients to pneumonia because of defective lung clearance

38 A. Verghese and S.L. Berk, "Bacterial Pneumonia in the Elderly," Medicine 62 (1983): 271.

mechanisms. Chronic alcoholism is a common process underlying pneumonia, increasing susceptibility to the illness due to a number of reasons. Patients with lung cancer or respiratory metastases are also prone to pneumonia, particularly if the tumor blocks a major airway. Finally, that growing class of patients whose immune system is somehow compromised (e.g., from cancer chemotherapy, splenectomy, immunosuppressive drugs, AIDS) are more likely to develop pneumonia. Each of these conditions which predispose patients to pneumonia also generally make the pneumonia more severe and difficult to treat.[39]

One additional dichotomy is helpful in assessing the potential severity of a pneumonia -- whether or not the infection was "community-acquired" or "hospital-acquired." Community-acquired pneumonias tend to occur in healthier, ambulatory populations and are generally caused by common agents (e.g., pneumococcus, viruses). They tend to be less severe. Hospital-acquired pneumonias are often caused by unusual organisms or antibiotic-resistant strains of bacteria. Since they occur in hospitalized patients, they by definition target a more debilitated population. Patients who have undergone invasive pulmonary procedures or who are intubated on ventilators are particularly susceptible. These pneumonias are usually more severe. Survival of a hospital-acquired pneumonia is intimately linked to the underlying status of the patient.

The above discussion outlines characteristics which predispose patients to severe pneumonias. But what is a severe pneumonia? A typical case of

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39 The pneumonia DRGs are separated into those with comorbidity (89) and those without (90). This split probably groups most patients with the conditions discussed in this paragraph into DRG 89. However, the DRG comorbidity list is sufficiently broad that it contains numerous conditions which do not necessarily predispose patients to pneumonia. Thus, DRG 89 incorporates both patients with and without these particular problems, leading to a clinically heterogeneous group.

community-acquired bacterial pneumonia should respond to antibiotic therapy within a few days. However, complications may arise.[40] The most fearsome is the adult respiratory distress syndrome (ARDS), in which the lung is overwhelmed and respiratory failure ensues. ARDS has been seen in every major form of infectious pneumonia. Treatment involves intensive care unit support and attachment to a respirator. Despite massive technological intervention, ARDS is often fatal. An additional complication is "superinfection" with a new bacterial pathogen. This generally occurs more than a week into the course of the original pneumonia, and results from the invasion of the lung by an organism resistant to the initial antibiotics. Finally, hospitalized patients have an alarmingly high rate of iatrogenic complications.[41] These range from drug reactions to those caused by use of invasive procedures and equipment.

Thus, the hospitalization of a pneumonia patient may vary from a short course of uncomplicated antibiotic therapy to a stormy and protracted stay in the intensive care unit. The severity of a pneumonia is closely linked to the underlying condition of a patient -- a severe pneumonia is not necessarily a random event. It is therefore possible to imagine scenarios in which particular physicians have caseloads skewed on the severity continuum. Innercity physicians who treat large numbers of alcoholics or debilitated elderly and physicians who specialize in treating malignancies (hematologists, oncologists) may have patients who are more severely ill than physicians who treat a healthier ambulatory population. These physicians may be at greater risk under a flat-rate payment for pneumonias.

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40 Certain complications (empyema and endocarditis, for example) would cause reassignment to different DRGs (79 and 126).

41 Knight Steel, et al., "Iatrogenic Illness on a General Medical Service at a University Hospital," New England Journal of Medicine 304 (1981): 638.

4.4 DISCRETIONARY USE OF RESOURCES

Because it is such a common disease, pneumonia is mainly the province of general medical doctors. However, there are several specialist consultants who may be tapped depending on the clinical complexities and needs:

Pulmonologists. Pulmonary specialists may be particularly helpful in a diagnostic dilemma. They perform such invasive diagnostic procedures as fiberoptic bronchoscopy, transbronchial biopsy, thoracentesis, and pleural biopsy. They also may be required to manage the patient in the ICU.

Infectious Disease (ID) Specialists. ID specialists may also assist in diagnosis. In addition, they are particularly skilled in selection of specific therapy. Given the plethora of antibiotics currently available, ID consultants may be best able to identify the most appropriate and cost-effective drug regimen.[42]

Intensivists. If a hospital employs intensive care unit specialists, they may become involved if the patient enters an ICU.

Anesthesiologists. An anesthesiologist may be called if the patient requires intubation for attachment to a respirator.

Surgeons. A surgeon may be consulted for opinions on a number of questions: open lung biopsies where diagnosis remains obscure, placement of a chest tube, and so on.

All these consultants focus on the pneumonia itself. However, since patients with severe pneumonias generally have some other serious underlying illness, additional consultants may be needed to address these comorbidities. For example, an oncologist may be asked to consult on a patient with lung cancer.

Multiple technologies and tests are also available for the work-up of pneumonia patients. Some of these (e.g., blood and sputum cultures, special serologies) generate mainly Part A costs (e.g., bacteriology laboratory). Others may have substantial physician costs. These discretionary resources are as follows:

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42 As a cost containment measure, some hospitals now require that physicians obtain ID consult approval for use of certain expensive antibiotics. At Boston City Hospital, for example, only three types of antibiotics may be prescribed without prior ID approval.

Chest X-Rays. The chest x-ray may be very helpful in suggesting the type of pathologic process and extent of lung involvement. However, repeated chest films may yield little additional information unless the clinical status of the patient has substantially changed.

Transtracheal Aspiration. If the etiology of the pneumonia remains unclear and if the patient's sputum is either nonexistent or nondiagnostic, a transtracheal aspiration may be performed. In this procedure, a large bore needle is placed through the patient's neck into his trachea to aspirate pulmonary secretions. These secretions are then studied for the infectious agent.

Thoracentesis. In this procedure, fluid is drained from the pleural space adjacent to the lung, through a needle inserted in the chest wall. This fluid is then examined for diagnosis.

Arterial Blood Gas Analyses. This test reveals the extent of oxygenation of the patient's blood, and is thus a measure of how well a patient's lungs are functioning.[43] It involves obtaining a sample of arterial rather than venous blood.

Bronchoscopy. If diagnosis is important but remains elusive, bronchoscopy may be performed, generally by a pulmonologist. In this test, a fiberoptic bronchoscope is inserted down the patient's throat into his lungs. Biopsies may be taken through this instrument.[44]

Finally, the most expensive discretionary resource may be the ICU itself. Sometimes the patient may be so obviously in respiratory failure that intubation and ventilator support is the only option. These patients must be placed in the ICU, and cared for by intensivists. However, in other cases, the need for ICU monitoring may not be so clearcut. If a hospital operates an ICU which on a given day happens to have a number of vacant beds, a physician may choose to place a marginal patient in the ICU. In these cases, ICU care is a discretionary resource.

4.5 DIFFERENCES IN THERAPEUTIC APPROACH

Treatment of pneumonia patients involves a dual purpose: first, erradication of the specific infection, using antibiotics for example; and

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43 At some hospitals, anesthesiologists bill separately for interpreting blood gas results.

44 If the patient is unstable, it may in fact be safer to choose a surgical procedure ("open lung biopsy," ICD Procedural Code 33270) rather than bronchoscopy. The patient would thus be reassigned to surgical DRG 75: Major Chest Procedures.

second, supporting the patient through bedrest, oxygen therapy, hydration, measures to mobilize sputum, and so on. None of these efforts are terribly controversial. Where hot disputes may arise, however, is in the selection of specific therapy. With the numerous antibiotics on the market today, a physician may be faced with a bewildering choice. What makes this choice important is that different antibiotics may have substantially different costs. For a single hospital stay, certain antibiotics may cost hundreds, even thousands of dollars. Since these issues exclusively affect Part A hospital costs, this problem will not be discussed in detail.

4.6 STATE DATA

The clinical discussion raises several potentially important issues: differential severity of illness, the role of comorbidity, and multiple discretionary resource options. Unfortunately the Medicare data set allows only a preliminary examination of these factors. This section will therefore attempt only a descriptive study emphasizing the impact of comorbidity on the cost of physician services for pneumonia patients.

As previously described, respiratory infections are sorted into a number of DRGs. More serious etiologies are grouped into DRGs 79, 80, and 81; these DRGs were assigned a higher hospital relative weight than the simple pneumonia DRGs (89, 90, and 91). The New Jersey and North Carolina Part B data confirms the appropriateness of this separation. Table 4.2 shows that the respiratory infection DRGs are significantly more costly than their simple pneumonia counterparts. From the diagnosis perspective, the respiratory infection DRGs in both states contain fairly specific ICD codes -- tuberculosis and aspiration pneumonia are the most common diagnoses, followed by lung abcess and Klebsiella pneumoniae and Pseudomonas pneumonias. This is compared to the pneumonia DRGs in which "pneumonia and bronchopneumonia, organism unspecified" are the most common diagnoses (see Figure 4.1).

TABLE 4.2

COMPARISON OF NUMBERS OF CASES AND MEAN PART B COSTS: DRGS

RELATED TO RESPIRATORY INFECTION

	Comparison	New Jersey N	New Jersey Mean Cost	New Jersey t-Test on a Mean[a]	North Carolina N	North Carolina Mean Cost	North Carolina t-Test on a Mean[a]
DRG 79:	Respiratory Infections and Inflammations, Age >69 and/or c.c.	398	$913	t=6.73 p<.001	522	$487	t=5.54 p<.001
	COMPARED TO						
DRG 89:	Simple Pneumonia and Pleurisy Age >69 and/or c.c.	4,772	$604	219, 399	4,714	$320	108, 226
DRG 80:	Respiratory Infections and Inflammations, Age 18-69 w/o c.c.	93	$865	t=3.68 p<.001	166	$475	t=5.20 p<.001
	COMPARED TO						
DRG 90:	Simple Pneumonia and Pleurisy Age 18-69 w/o c.c.	840	$562	142, 464	1,401	$311	102, 226
DRG 89:	Simple Pneumonia and Pleurisy Age >69 and/or c.c.	4,772	$604	t=2.00 p<.05	4,714	$320	t=0.97 N.S.
	COMPARED TO						
DRG 90:	Simple Pneumonia and Pleurisy Age 18-69 w/o c.c.	840	$562	1, 83	1,401	$311	-9, 27
DRG 89:	Simple Pneumonia and Pleurisy Age >69 and/or c.c.	4,772	$604	t=4.82 p<.001	4,714	$320	t=5.05 p<.001
	COMPARED TO						
DRG 87:	Pulmonary Edema and Respiratory Failure	2,384	$674	42, 98	850	$390	43, 97

a Includes minimum and maximum values of a 95% confidence interval around the difference of mean Part B costs for the two DRGs under comparison.

Table 4.2 also includes the somewhat surprising result that DRGs 89 and 90 have fairly similar mean Part B costs. Costs in DRG 89 are higher as expected, by $42 in New Jersey and $9 in North Carolina.[45] But these are relatively small differences given that DRG 89 supposedly has the sicker caseload -- older patients and those with comorbidities and complications.[46] Why are these costs so similar?

1. Similar proportions of specialists serve as the attending physician in both DRGs 89 and 90 in New Jersey (see Table 4.3). In North Carolina the differences are statistically significant, with the suggestion that patients in DRG 90 actually have more specialists as attending physicians than patients in DRG 89. But the differences are only two to three percentage points.

2. Similar fractions of patients are obtaining medical and surgical consultations in both DRGs 89 and 90 in each state (see Figure 4.2). In New Jersey, patients are three to four times more likely to receive medical consultations than in North Carolina.

3. Similar proportions of patients obtain diagnostic surgeries in DRGs 89 and 90. In New Jersey, 18.3% of DRG 89 and 17.3% of DRG 90 cases receive diagnostic surgeries. In North Carolina, 10.6% of DRG 89 and 12.7% of DRG 90 cases receive these services.

4. Patients appear equally likely to be admitted to an ICU in DRGs 89 and 90 in both New Jersey and North Carolina. Mean ICU Part B payments are also similar. DRG 89 is $14 more costly in New Jersey, and DRG 90 is $9 more expensive in North Carolina (see Table 4.4).

This latter similarity is particularly unexpected given the length of stay data. Overall mean LOSs are significantly different in both states: DRG 89 mean stays are 2.70 days longer in New Jersey and 1.86 days longer in North Carolina.[47] These LOS differences remain even if one breaks down

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45 Part A costs are significantly higher for DRG 89 over DRG 90 in New Jersey ($t=5.76$, $p<.001$). But in North Carolina, Part A costs in DRG 89 are only $131 higher -- not a statistically significant result.

46 The North Carolina data must be interpreted with some caution because North Carolina did not code comorbidities in 1982. North Carolina cases were assigned to DRG 89 on the basis of older age alone.

47 These 2.7 days in New Jersey could easily account for the extra $42 mean Part B cost of DRG 89 over DRG 90, by representing merely extra daily visit charges, not higher intensity of services (e.g., more diagnostic surgeries).

TABLE 4.3

SPECIALTY OF ATTENDING PHYSICIAN

(PERCENT OF CASES)

	NEW JERSEY[a]		NORTH CAROLINA[b]	
Specialty	DRG 89 (N=4712)	DRG 90 (N=840)	DRG 89 (N=4714)	DRG 90 (N=1401)
General/Family Practice	22.7	20.8	46.7	43.4
Internal Medicine	57.9	57.6	47.7	49.4
Cardiology	6.1	5.6	1.0	0.9
Pulmonary Disease	3.9	4.8	1.1	1.4
Other	9.4	11.2	3.5	4.9
	100.0	100.0	100.0	100.0

a Chi-square comparing DRG 89 and DRG 90 data yielded x^2=4.89, N.S.

b Chi-square comparing DRG 89 and DRG 90 data yielded x^2=14.13, p<.01.

Figure 4.2
Percent of Patients Receiving
Medical and Surgical Consultations
PNEUMONIA DRGs

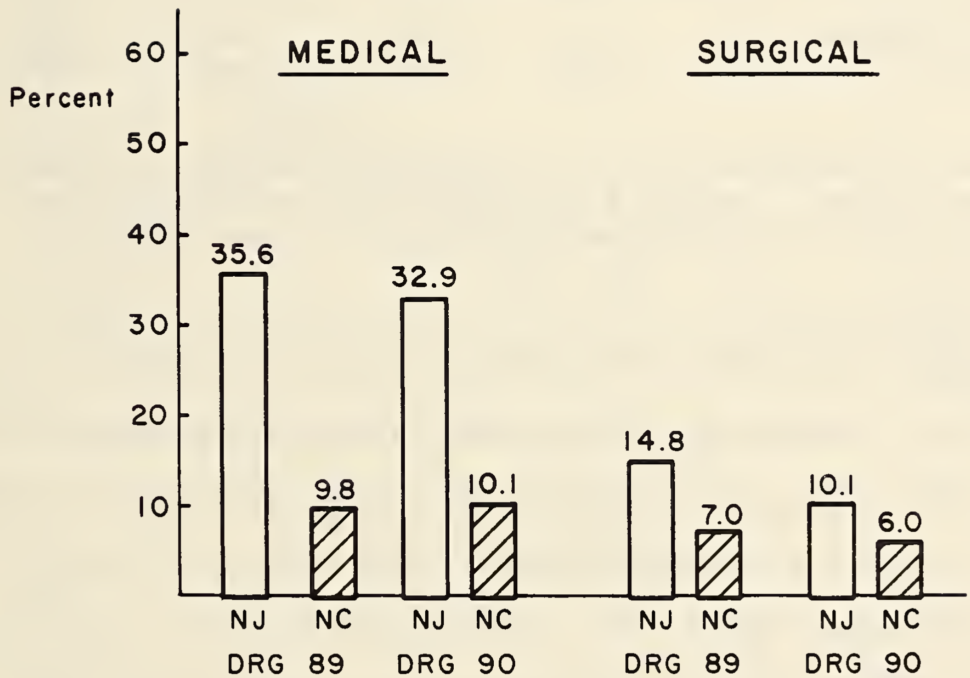


TABLE 4.4

INTENSIVE CARE UNIT MEAN COSTS

(PERCENT OF ADMISSIONS)[a]

	NEW JERSEY		NORTH CAROLINA	
Type of Cost	DRG 89	DRG 90	DRG 89	DRG 90
Part A ICU Mean Cost	$2,046 (13%)	$1,631 (13%)	$1,166 (10%)	$1,108 (9%)
Part B ICU Mean Cost	$185 (12%)	$171 (11%)	$140 (8%)	$149 (7%)

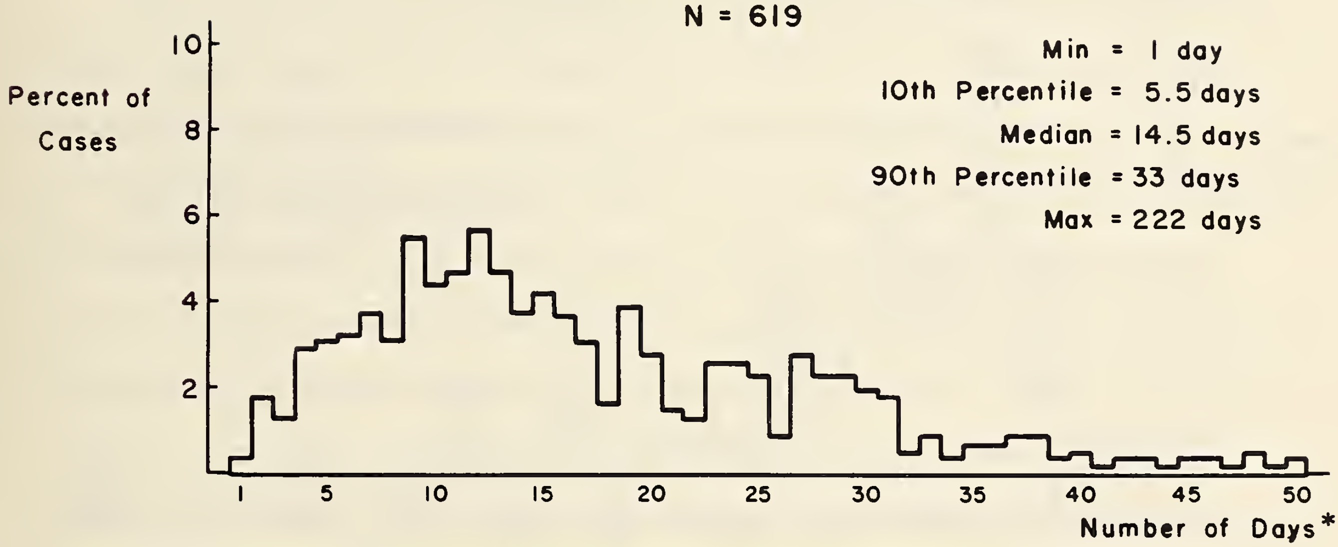
a Percent of admissions with ICU billing for Parts A and B appears in parentheses. The Part A and B percentages may not always be equal because sometimes physicians do not bill separately for ICU care.

patients having ICU stays from those without ICU care (see examples for New Jersey in Figures 4.3 and 4.4). In both DRGs 89 and 90, patients with ICU stays have longer LOSs. But ICU cases in DRG 89 stay longer than ICU cases in DRG 90 (even though they have similar costs, see Table 4.4). The same is true for non-ICU cases, with DRG 89 cases staying longer than DRG 90 cases. If outlier status were determined for pneumonia cases overall, DRG 89 would appear to contain a higher proportion of LOS outliers. By removing these outliers, DRG 89 and 90 mean costs may be even closer.

The data thus far suggest that patients in DRGs 89 and 90 receive similar physician services, at least so far as cost is a proxy. In fact, per diem physician costs are higher in DRG 90 than in DRG 89 (per diem Part B costs are $42 for DRG 89 and $48 for DRG 90 in New Jersey; per diem costs are $26 for DRG 89 and $30 for DRG 90 in North Carolina). In the current hospital system, DRG 89 is weighted more heavily than 90 (1.1029 compared to 0.9849). However, the preliminary data presented above imply that discrepant relative weights

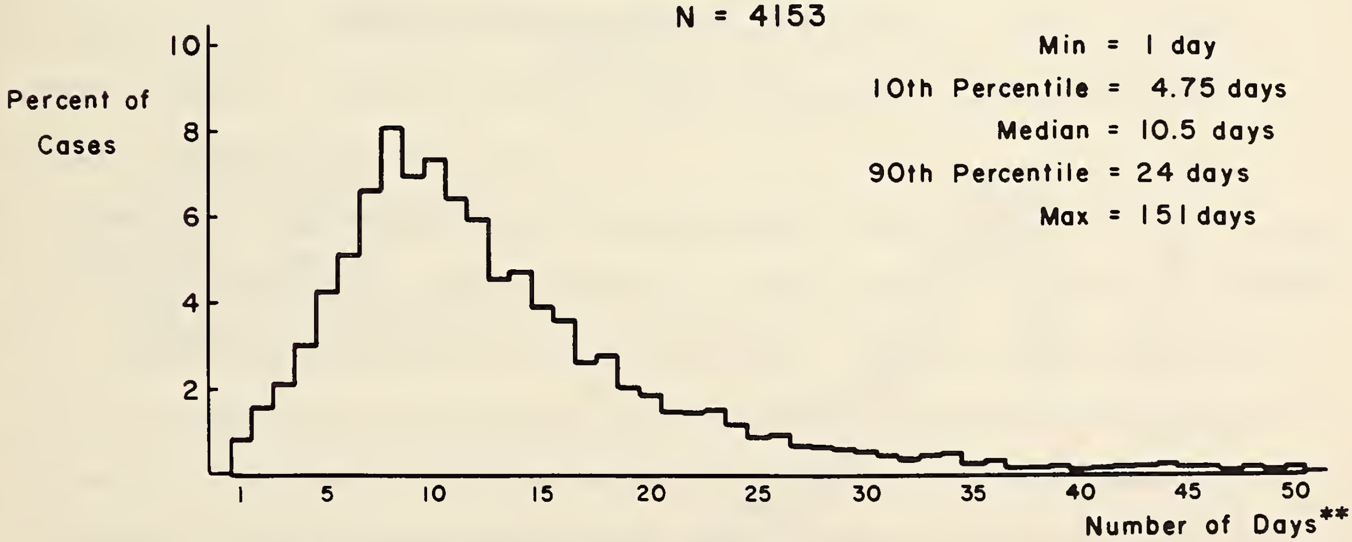
Figure 4.3
Length of Stay for Cases in DRG 89, New Jersey: Separated by Receipt of ICU Care

A. Cases Receiving ICU Care
N = 619



*2.9% of cases remain above this 50-day cut-off.

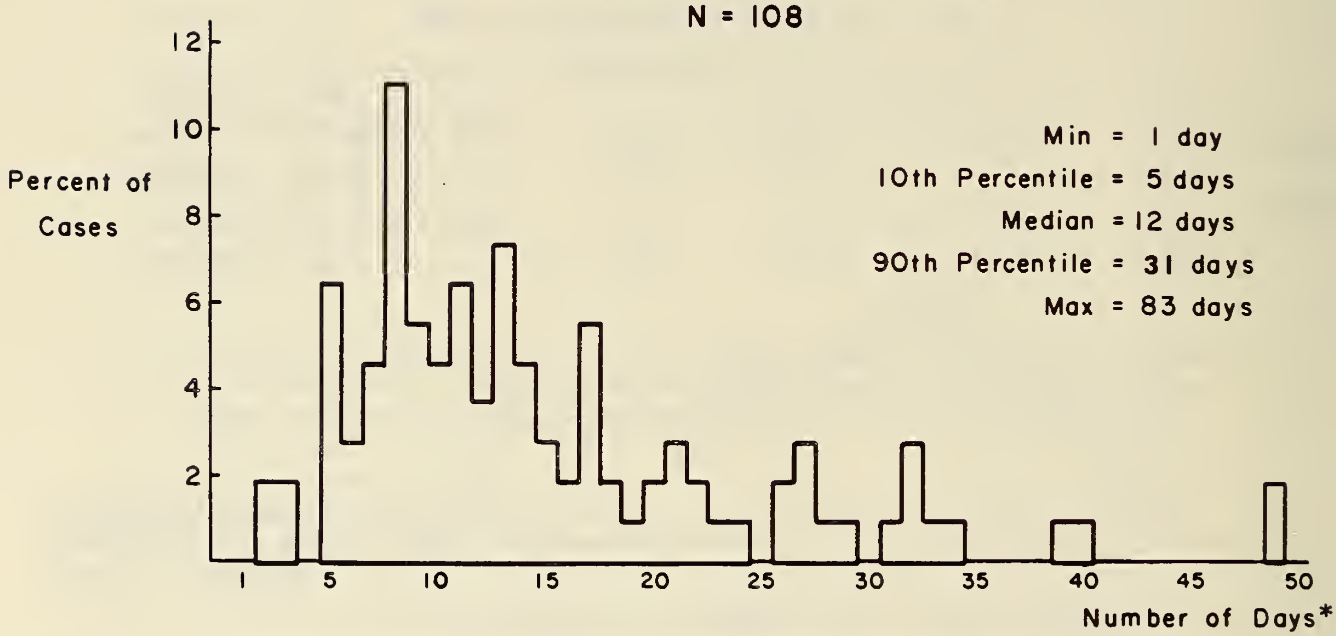
B. Cases Not Receiving ICU Care
N = 4153



**1.5% of cases remain above this 50-day cut-off.

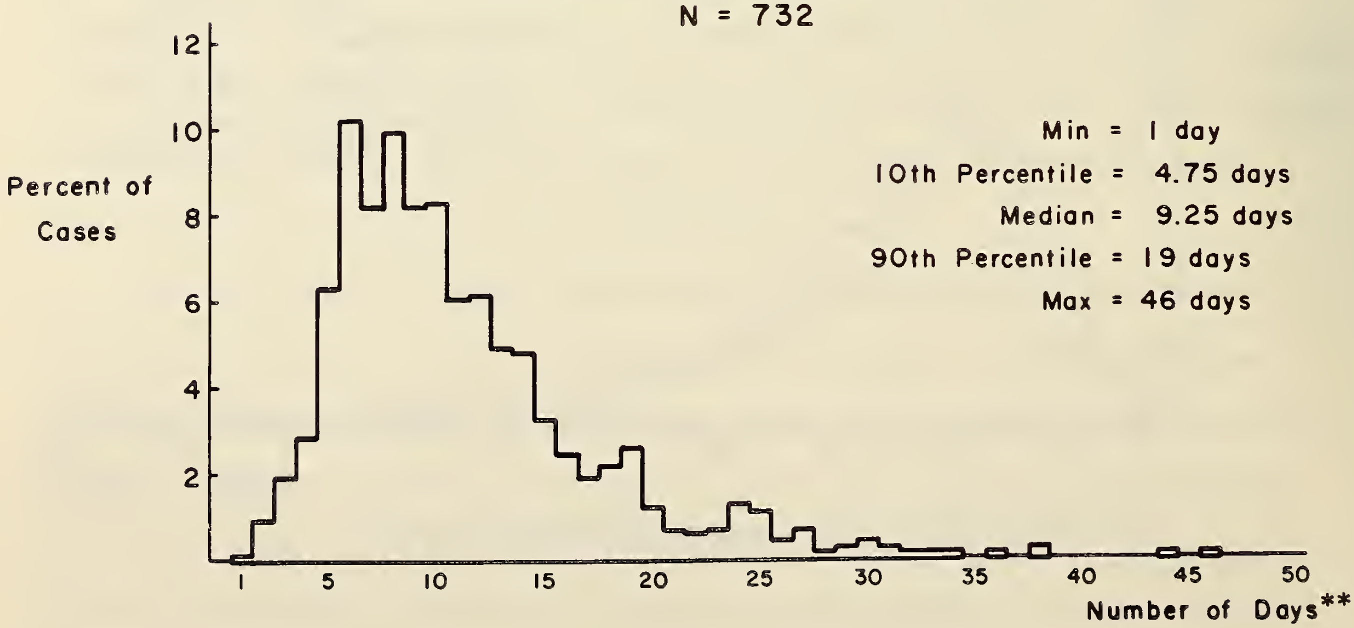
Figure 4.4
Length of Stay for Cases in DRG 90, New Jersey:
Separated by Receipt of ICU Care

A. Cases Receiving ICU Care
N = 108



*1.9% of cases remain above this 50-day cut-off.

B. Cases Not Receiving ICU Care
N = 732



** No cases remain above this 50-day cut-off.

may not be appropriate for physician reimbursement. Physician payments may be equally equitable if DRGs 89 and 90 were collapsed into one. If pneumonia-wide outlier parameters were established (i.e., not determining outliers separately for 89 and 90), the results may be paradoxical -- DRG 90 may have greater costs than DRG 89. This issue clearly requires further study.

One final issue must be considered. The clinical discussion emphasizes that although the etiology of pneumonia is important in ascribing severity and prognosis, perhaps of greater value is the comorbidity of the patient. Yet DRG 89 incorporated this factor, and from this superficial analysis, it seems to have had little influence on cost. Why? What are the comorbidities claimed on behalf of DRG 89 patients?[48] Only 35.6% (1,698) of the 4,772 cases had secondary diagnoses coded. Of these, 31% (527) of the codes were "00000" (i.e., the secondary diagnosis slot was filled in with zeroes, not with a meaningful diagnosis). The remaining 69% had literally hundreds of different diagnoses, some of which did not qualify as DRG-accepted comorbidities (e.g., Codes 40110, 40190: Essential Hypertension; Code 25000: Uncomplicated Diabetes, Adult or Unspecified Onset; Codes 41400, 41490: Chronic Ischemic Heart Disease). A list of the most common DRG-accepted comorbidities and their caseloads is in Table 4.5.

Several observations arise from these data. First, disorders such as COPD and diabetes in an elderly population hospitalized for pneumonia are far more common than suggested by these percentages. The most likely explanation is that physicians are not listing these secondary diagnoses on the discharge summary. As secondary diagnosis becomes more crucial for reimbursement purposes, it will probably appear more often. Second, by flipping the order of some of these diagnoses (e.g., septicemia, respiratory failure) the patient

48 Secondary diagnosis data are only available for New Jersey.

TABLE 4.5

MOST COMMON DRG-ACCEPTED COMORBIDITIES

AND THEIR CASELOADS

Comorbidity	Number of Cases	Percent of Total Pneumonia Cases[a]
Septicemia	32	0.6%
Lung Cancer	32	0.6%
"Complicated" Diabetes	44	0.8%
Fluid, Electrolyte, Acid-Base Imbalance	64	1.1%
Cardiac Dysrhythmias	27	0.5%
Heart Failure	109	1.9%
Chronic Obstructive Pulmonary Disease (COPD)	141	2.5%
Respiratory Failure	34	0.6%

a DRG 89 + DRG 90 = 5612 total cases.

would fall into a DRG which under the current hospital relative weights has a higher reimbursement level. As shown in Table 4.2, patients in the respiratory failure DRG (87) do have significantly higher Part B costs in both New Jersey and North Carolina. Pneumonia patients with respiratory failure may in fact be many of the outlier cases. "DRG creep" in this instance may thus make both medical and pecuniary sense. This issue is discussed further in the next section on implications of the prospective payment system.

4.7 IMPLICATIONS OF THE PROSPECTIVE PAYMENT SYSTEM FOR PHYSICIAN BEHAVIOR

The pneumonia DRGs present a number of potential incentives for change in physician behavior. The first occurs at the door to the hospital, whether or not to admit the patient. This decision in the past has involved balancing a clinical assessment of the severity of a patient's pneumonia against the risks of hospitalization -- hospitalized pneumonia patients are at risk of developing a superinfection with the recalcitrant bacteria which colonize hospitals, thus resulting in prolonged stays. Under a PPS, financial concerns may further complicate this decision. Superinfection usually occurs more than a week into the course of the pneumonia. Therefore, physicians may choose to admit patients for brief initial drug therapy with early discharges. Some physicians may make an effort to manage appropriate patients exclusively at home. In any case, it is likely that lengths of stay may decrease. Quality of care may even improve if the number of superinfections is reduced.

However, early discharges may in fact increase costs by in essence splitting admissions. Pneumonia patients are particularly prone to relapse, as a partially treated pneumonia reactivates.[49] Patients discharged to home may forget to take their medications or may not adequately rest and eat.

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49 This is confirmed by the state data. In New Jersey, 20% of pneumonia cases were readmitted within one week of discharge from the first hospitalization. This 20% figure, however, is somewhat higher than clinically expected.

Those patients discharged early may be particularly vulnerable. When their pneumonia reappears, they may require a second medical admission for a condition which should have been treated in a single stay. In these cases, total costs may be substantially higher.

Invasive therapy (e.g., intubation) and testing (e.g., bronchoscopy) present similar trade-offs. Clinical benefit/risk calculations may be clouded by the financial incentives of a physician prospective payment system. In certain cases, it is readily apparent that the patient will die unless he is intubated and attached to a respirator. In others, it is not so obvious. Intubation clearly involves certain risks which could prolong hospital stays. Similarly, bronchoscopy carries its own risks. The need to have a definitive diagnosis must be balanced against potential complications. If the attending physician must now share his fee with the pulmonary specialist bronchoscoper, perhaps fewer bronchoscopies will be performed.

The consultation issue may differentially affect different specialties. Attending physicians may be more willing to split their fee with a specialist performing a specific procedure (e.g., bronchoscopy) than with a specialist providing purely "cognitive" input (e.g., an infectious disease specialist advising on antibiotic management). ID specialists may be particularly likely to lose in a physician PPS.

Another case of physicians likely to lose are those treating patients with disorders predisposing them to severe pneumonias (e.g., alcoholism, extreme old age, COPD, AIDS, cancer). Physicians treating numerous urban poor, for example, may be at greater risk of having pneumonia cases skewed toward more severe disease. Physicians at tertiary care referral centers treating patients with numerous comorbidities and "hospital-acquired" pneumonias may also have more severe cases. These physicians would lose under an average cost payment system. To the extent possible, physicians may attempt to manipulate their caseloads to avoid those patients prone to protracted and costly pneumonias.

A further implication involves increased use of empirical therapy. As mentioned earlier, the exact infectious etiology of a pneumonia may often remain obscure. Therapies are then chosen on an epidemiologic basis -- by looking at the patient's presentation, examining probabilities of various etiologies, and selecting the most likely. However, numerous diagnostic technologies are available to enhance the chance of positively identifying the offending organism. Since these tests may involve costs which an attending physician may not be willing to share, physicians may be more likely to opt for the empirical approach. This may mean that some patients may not initially receive appropriate antibiotic therapy. But the implication for overall costs is not clearcut.

Finally, pneumonia may also offer an opportunity for DRG creep. As mentioned earlier, certain pneumonias qualify for the better paid respiratory infection DRGs (79, 80, 81). It may be worth extra diagnostic costs to identify an organism which would push a patient into these DRGs. In addition, pneumonia often occurs in the setting of substantial comorbidity and severe complications may occur. It may be possible to reassign patients to a more lucrative DRG by manipulating the ordering of diagnoses. For example, if the patient has respiratory failure (ICD Code 79910) on the basis of pneumonia, it would be more lucrative to list respiratory failure as the principal diagnosis.[50] Respiratory failure falls into DRG 87 with a relative weight of

50 This is another instance where the ICD codes confuse types or levels of diagnoses. Respiratory failure is a clinical event whereas pneumonia is a clinical diagnosis. They are not mutually exclusive categories. Therefore, it makes perfect clinical sense to list a patient in either category. If there is a financial incentive favoring one category over another, the better paid one should always win.

1.5529, whereas the complicated pneumonia DRG 89 has a weighting of 1.1029. Another example where levels of diagnoses become obscured is the septic patient (a patient in which the bacteria causing the pneumonia enter the patient's bloodstream). DRG 416: Septicemia Age > 17 has a relative weight of 1.5504. Finally, an example of coexisting clinical diagnoses is the patient with lung cancer and pneumonia. Respiratory neoplasms (DRG 82) are weighted at 1.1400. In fact, most of the malignancy DRGs have higher relative weights than DRG 89. Thus, ample avenues for DRG creep exist with the pneumonia DRGs, and this practice may be clinically completely correct. The underlying problem that the ICD system does not always create mutually exclusive categories is at the core of this concern.

4.8 SUMMARY AND CONCLUSIONS

Pneumonia is a very common disease within an elderly population, costing the Medicare system millions of dollars annually. Despite this high incidence, pneumonia is neither a homogeneous clinical entity nor one which physicians all approach in an identical fashion. These factors may account for the considerable variability observed in physician costs for DRGs 89 and 90.

Determining the exact cause of a pneumonia may be a frustrating exercise; the offending organisms often elude identification. Therefore, it is not surprising that most New Jersey and North Carolina pneumonia cases fall into very non-specific ICD codes. Patients without exact etiologies are treated empirically, based upon a best guess of the cause given the clinical presentation. But some cases may demand an exact diagnosis; some physicians may pursue diagnosis more vigorously than others. A wide range of discretionary resources may be recruited in this search, with differential impact on physician costs.

Pneumonia may present at many points along the severity continuum -- from a patient requiring a few days of intravenous antibiotics to one requiring ventilator support in an ICU. One of the most important determinants of severity is comorbidity; another is old age. DRGs 89 and 90 are split along these parameters, with DRG 89 including the older, sicker caseload. However, when DRG 89 and 90 Part B costs were compared in New Jersey and North Carolina, they were very similar. DRGs 89 and 90 had similar numbers of specialists serving as attending physicians, similar consultation rates, similar diagnostic surgery rates, and similar rates of admission to ICUs. One very important exception to this pattern is the significantly longer length of stay of DRG 89 in the two states. The slightly higher DRG 89 Part B costs could thus be attributed soley to extra daily visit fees, not greater intensity of service (e.g., more diagnostic tests). There is some indication that the 1982 data may not include a complete listing of all comorbidities in the pneumonia patients. However, these preliminary data do suggest that DRGs 89 and 90 may possibly be equitably combined for physician reimbursement, thus removing the incentive for DRG creep between these two DRGs. This area warrants further study.

Using DRGs to reimburse physicians for care of pneumonia patients raises certain implications similar to those for hospitals:

1. <u>Length of Stay</u>. Hospitals have an incentive to shorten length of stay. Physicians have the same incentive.

2. <u>Diagnostic Work-Up</u>. Hospitals have an incentive to minimize the extent of diagnostic work-up. Physicians have the same incentive. This may result in increased reliance upon empirical therapy.

3. <u>DRG Creep</u>. Hospitals have an incentive to assign patients to the most lucrative potential DRG. Physicians have the same incentive. This may result in a paradoxical increase in diagnostic work-up, if the work-up may result in reassignment to a better paid DRG.

4. <u>Case Mix</u>. Hospitals have an incentive to avoid potentially costly patients and to admit less complex patients. Physicians have the

same incentive, but may choose simply not to admit the "easy" cases (to avoid potential costs of hospital-acquired superinfections).

5. ICU Care. Hospitals have an incentive to minimize use of costly ICU services. Physicians have the same incentive.

These implications may not only have an impact on costs, but may also significantly affect quality of care. Will patients who are discharged early return to the hospital because of recrudescence of their disease? Will more mistakes be made in empirical therapy? Will patients who are not admitted to the ICU at first suspicion of profound respiratory failure suffer from emergency intubation on the general medical floor? These quality of care concerns must be further addressed.

Chapter 5

DRG 82: RESPIRATORY NEOPLASMS

5.1 INTRODUCTION

Respiratory neoplasms, or lung cancers, are the leading cause of cancer death among American males.[51] In women lung cancer is second only to breast cancer, but is gaining steadily. In fact, while the incidence of cardiovascular disease and stroke is declining, the occurrence of lung cancer continues to climb. It is now considered a major medical epidemic of the twentieth century.

As with many malignancies, lung cancer arises most commonly in an elderly population. In 1983, 2% of patients over 65 discharged from short-term hospitals bore a diagnosis of lung cancer. These patients may be admitted multiple times, as the illness progresses and metastasizes. As expected, DRG 82 has a large caseload: 3,367 cases in New Jersey and 2,482 cases in North Carolina. Costs are similarly high totalling $12,979,785 in New Jersey and $7,311,972 in North Carolina. These costs, however, display substantial variability. Part A CVs were 1.0320 in New Jersey and 1.2310 in North Carolina; Part B CVs were 0.8400 in New Jersey and 1.0620 in North Carolina. These high CVs are similar to those observed for DRGs pertaining to other malignancies (e.g., gastrointestinal cancer, lymphoma, and leukemia). What clinical factors may contribute to this cost variability?

1. Lung cancer is not a single clinical entity; there are several different cell types which have different behaviors and may require different therapeutic approaches.

2. Lung cancer may present along a wide severity continuum, often equated with "stage" of the tumor. Different stages may demand different resources.

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51 The term "neoplasm" means only new growth and can technically represent both benign and malignant conditions. However, benign lung tumors are exceedingly rare. Therefore, this discussion will focus only on malignant disorders.

3. Aspects of therapy and work-up of lung cancer remain both discretionary and controversial. Therefore, different physicians confronted with the same patient may proceed in a very different manner.

The following discussion considers each of these points in succession. The issues raised may actually be generic to many malignant diseases which have widespread systemic effects and generally no definitive cure.

5.2 DEFINITIONAL PRECISION

DRG 82 contains 39 separate ICD codes which classify the respiratory neoplasms three ways. First, they are divided into "malignant" and "benign" conditions. Second, neoplasms are divided into "primary" and "secondary" tumors. Primary tumors are those arising directly from the cells of the trachea, bronchus, lung or closely adjacent structures. Secondary tumors originate in distant organs, such as the breast, kidney or ovary. When these tumors metastasize to the lung, the disease is classified as a secondary respiratory neoplasm. Third, respiratory neoplasms are categorized according to the anatomic site within the respiratory system where the tumor is found. The ICD codes meticulously specify the site of the tumor as follows: trachea; bronchus (major airways in the lung); upper, middle or lower lobes of the lung; pleura (the membrane which lines the outer surface of the lung); the ribs, clavicle, or sternum; and the mediastinum (the mass of lymph nodes, blood vessels, thymus gland, and other structures lying the space between the two lungs).[52] Despite this detailed classification scheme, one of the most crucial pieces of information is conspicuously missing -- tumor cell type.

Primary lung cancer is not a homogeneous clinical entity. Four major types of lung cancer are described classified according to their specific

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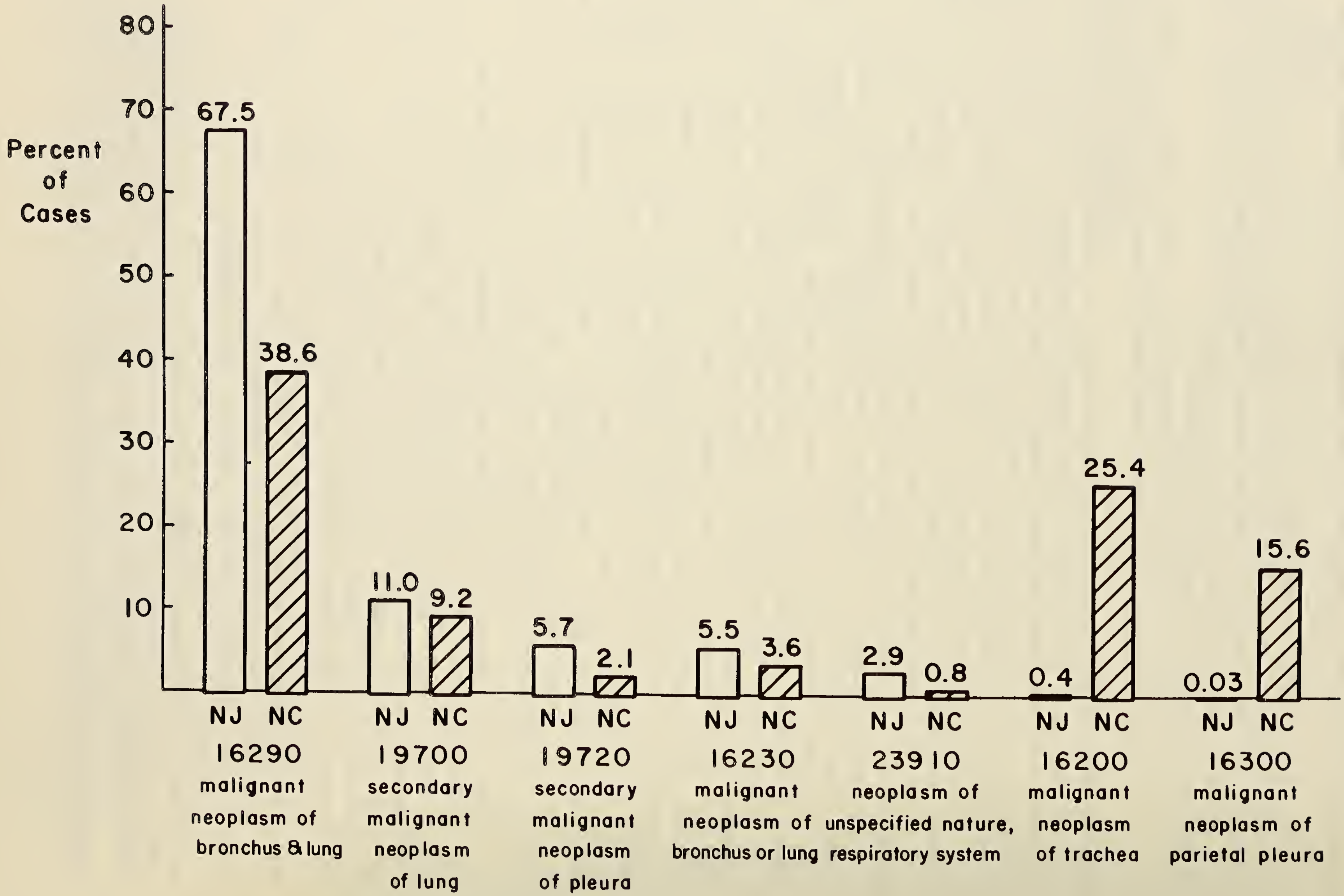
52 These boney structures and the mediastinum are technically not part of the respiratory system. But perhaps because they are anatomic neighbors of the lung, they are grouped under DRG 82. Disorders in these sites do not contribute significantly to the DRG 82 caseload in New Jersey and North Carolina.

cells of origin: squamous cell carcinoma (accounting for 40% to 50% of all primary lung cancers); small cell carcinoma (15% to 20%); adenocarcinoma (15% to 20%); and large cell carcinoma (15% to 20%). In addition, the pleura produces its own specific types of cancer; mesothelioma is the most common and is generally related to asbestos exposure.

The differences in lung cancer types are of more than pathologic interest because each is associated with characteristic biologic behaviors. The different cancers have different growth rates and patterns of spread; they often arise in different sites in the lung, causing symptoms of differing urgency and severity; the prognosis of each cell type of cancer is different; and finally, the different types dictate different approaches to therapy (e.g., chemotherapy versus surgery). For example, because squamous cell tumors generally originate close to the largest airways, they may cause symptoms (e.g., coughs producing blood) earlier in their course. An early squamous cell cancer may be surgically cured. Small cell cancer, however, is almost always metastatic by the time it is first detected. Chemotherapy is the only treatment option. Mesothelioma is virtually incurable regardless of when it is detected. Chemotherapy has been tried, but with little success.

Thus, although at first glance DRG 82 appears narrowly defined, in fact it incorporates multiple clinical entities. The source of this clinical heterogeneity is two-fold: first, lung cancer itself is not a single disease; and second, incorporating metastatic disease invites inclusion of a number of malignancies with the propensity for lung spread (e.g., breast, testes, colon, and prostate cancers; melanoma, sarcoma, and lymphoma). Given this background, what types of lung cancer cases are being seen in New Jersey and North Carolina? ICD coding styles and indeed diagnoses appear somewhat different in the two states (see Figure 5.1):

Figure 5.1
Five Most Common ICD Diagnoses
in DRG 82



1. In both New Jersey and North Carolina, primary lung cancer encompasses the largest single share of the caseload: 73.0% in New Jersey and 42.2% in North Carolina fall into ICD codes for primary lung cancer, site unspecified (16290) or upper lobe of lung (16230).

2. One piece of North Carolina data is unexpected: 25.4% of cases fall into Code 16200, malignant neoplasms of the trachea.[53] This ICD category was not mentioned among the five most frequent diagnoses in New Jersey. In fact, primary neoplasms of the trachea rarely arise, occurring one-twentieth as often as bronchogenic tumors. It is likely that the coding and classification of trachea tumor is actually an error. The "malignant neoplasms of the trachea" probably represent additional cases of cancer from the airways of the upper lobe of the lung. Frequently a tumor at this site lies close to, and invades, the trachea. Thus, if one adds this 25.4% to the 42.2% mentioned above, 67.6% of North Carolina's cases are probably primary lung cancers.

3. The second largest category of patients in North Carolina is Code 16300, primary neoplasms of the pleura. This diagnostic category, accounting for 15.6% of all North Carolina cases, was not mentioned in the top five in New Jersey. Pleural neoplasms may include mesothelioma as well as misclassified secondary neoplasms which have metastasized to the pleura.

4. Metastatic disease actually accounts for a sizeable portion of the caseload in New Jersey (16.7%). Its share is less in North Carolina (11.3%), but it is still an important diagnosis. As mentioned above, the primary malignancy could originate in one of numerous organs. This group could thus represent an extremely heterogeneous spectrum of clinical entities.

In summary, the neatness of its title, Respiratory Neoplasms, belies the clinical complexity of DRG 82. The DRG is defined by a series of ICD codes which are mainly anatomic. With the exception of differentiating tumors into primary lung versus metastatic disease, the ICD codes reveal little about the type of cancer or its biologic behavior. This is important from a resource perspective: some cancers respond to surgery in their initial stages (squamous cell, adenocarcinomas), others require chemotherapy (small cell), and for others there is little to be done (mesothelioma). DRG 82 also

53 One additional explanation of this unexpected finding is that North Carolina coders are not following the ICD-9-CM stipulation of coding all five digits. They may only list three digits, 162, indicating that the diagnosis falls under the lung cancer heading. The zeroes are added by the computer in grouping. Both 1620 and 16200 indicate trachea cancer.

includes metastatic tumors, opening the possibility of encompassing a wide variety of diseases. North Carolina and New Jersey appear to code DRG 82 cases somewhat differently. In fact, North Carolina's practice of denoting numerous cases of trachea cancer may be clinically inaccurate or represent inadequate coding. Finally, the inclusion of metastatic tumors may present a perfect opportunity for "DRG creep." This possibility will be discussed further in Section 5.7.

5.3 SEVERITY OF ILLNESS

Except in the few cases where it is caught in an early, surgically resectable state, lung cancer is an incurable disease. The tumor progresses along a characteristic course dictated by the cell type of the cancer -- invasion of local structures (airways, blood vessels, nerves), metastatic spread. As time passes, a patient's illness thus becomes more and more severe. Does this mean that it becomes increasingly costly to treat the lung cancer patient as his disease becomes more widespread and destructive? One possible hypothesis assumes a straightforward positive correlation between cost and severity of illness. However, as this lung cancer example suggests, the relationship may not be this clearcut. In fact, a paradox may arise: care at the earliest indication of disease may be most costly while terminal care may be comparatively cheap.

In its earliest stage, lung cancer may be asymptomatic. Tumors may be spotted on a routine chest x-ray; high risk patients (e.g., those with a history of asbestos exposure) may be identified during screening. Other patients may seek attention when symptoms arise, such as shortness of breath, coughing up blood, and recurrent pneumonias. During the initial hospitalization, the physician has multiple goals: to identify the specific type of tumor, to specify the perimeters of local invasion, and to determine the extent of metastases. As will be discussed in the discretionary resource section, achieving these goals requires the mobilization of numerous resources. Because of this initial barrage, the first admission may be extremely expensive.

If medical management is chosen, subsequent admissions for chemotherapy may be brief. During its course, however, lung cancer has a propensity for dissemination throughout a variety of organs -- brain, liver, bone and bone marrow, adrenal glands and so on. With additional metastatic involvement, therapy reorients towards treating the consequences of this other organ involvement as well as maintaining chemotherapy directed against the original tumor. During this "intermediate" period (between initial discovery and terminal care), costs may become more proportional to severity. For example, a severe pneumonia caused by blockage of an airway by tumor may necessitate treatment in an intensive care unit, with obvious cost implications, both for the hospital and physician.

Once the patient reaches the final stages of his disease, he may make certain choices about the direction of his care. Some patients may choose to "go out fighting," opting for continued life support in intensive care units and resuscitation efforts. Others may choose to suspend use of heroic measures, desiring only to be kept comfortable. These patients complete the paradox: they are terminally ill but they cost little in terms of physician resources. Specialists are no longer required for diagnostic testing or therapeutic planning. The only physician service may be the routine visit of the patient's general medical doctor.

Thus, patients with lung cancer may present at many points on the severity continuum. Costs may not always directly parallel severity of disease; cost may be high at the time of discovery and low at the time of death. These issues may actually be generic to most areas of oncology. However, in conclusion two additional considerations specific to DRG 82 must be mentioned:

1. Comorbidity. Lung cancer patients may also have significant comorbidities. Most smoke and are at high risk to have bronchitis, emphysema and cardiovascular diseases. Yet DRG 82 is the only respiratory neoplasms category, no provision is made for age or comorbid or complicating conditions. One may expect that patients with additional diseases may have a stormier course, requiring extra expense (e.g., additional consultants and diagnostic tests).

2. Metastatic Disease. DRG 82 includes ICD codes for secondary lung tumors -- cancer metastatic to the lung from other organs. By definition these patients have severe diseases because their primary tumors have invaded a distant structure, the lung. However, the course of these other tumors may be highly variable (e.g., testicular cancer metastases may melt away with chemotherapy whereas breast cancer metastases are recalcitrant to intervention). These secondary tumors may thus also have highly variable costs.

5.4 DISCRETIONARY USE OF RESOURCES

By definition, the diagnosis of lung cancer requires a specialist and diagnostic procedures. Although the chest x-ray is the primary tool for the detection of respiratory neoplasms, by itself it is inadequate to make the diagnosis. No specific shadow pattern or radiographic abnormality unequivocally indicates cancer. This is especially true for the early coin-sized lesions, those that one is most eager to find on the screening chest x-ray. Infections, congenital abnormalities, blood clots and many other benign conditions simulate lung cancer. The diagnosis is not definitive until a piece of tissue is examined under the microscope by a pathologist.

As suggested in the previous section, a diagnosis of "lung cancer" alone is not adequate. To properly plan therapy the tumor must be classified as either lung primary or metastatic disease, and the exact cell type of the tumor must be determined. The pursuit of exact diagnosis, however, may entail significant physician costs. The goal is to obtain cells for microscopic analysis; there are several ways to proceed:

1. Sputum Cytology. This cheapest option involves examining a patient's sputum for malignant cells. Unfortunately, establishing a specific diagnosis is rarely possible using this simple technique.

2. Bronchoscopic Diagnosis. If the tumor is within easy reach, a pulmonologist may be asked to perform a bronchoscopy. During bronchoscopy, a flexible lighted tube is inserted through the mouth and into a bronchus near the tumor. Patients require sedation, but not general anesthesia. Biopsies, scrapings and brushings of the tumor can be taken, and any distortion or obstruction of the bronchus itself can be seen directly.

3. Percutaneous Needle Biopsy. If the suspected tumor is in a location out of the reach of the bronchoscope or if the bronchoscopic biopsy is unsuccessful, the suspicious lesion may be sampled by percutaneous needle biopsy. In this procedure, the pulmonologist inserts a long thin needle through the skin and chest wall into the lung and a portion of the mass is sampled. Often the needle must be guided by the special x-ray techniques of fluoroscopy or ultrasonography.

4. Open Lung Biopsy. If both fiberoptic bronchoscopy and percutaneous needle biopsy fail, an open lung biopsy may be required. In this procedure, a surgeon opens the chest, exposes the lung, and biopsies the tumor.[54]

Unfortunately, no single procedure yields an adequate diagnosis in all patients with lung cancer. For example, bronchoscopic examination, with biopsies, brushings and washings, produces correct diagnoses in only two-thirds of patients. Often a combination of tests is needed. Through application of one or more procedures a tissue diagnosis is possible in 85% of patients. Variable use of these techniques (due to individual physician practice styles, patient factors, and tumor traits) could contribute to considerable heterogeneity in physician costs.

Once the specific type of malignancy is identified, therapy must be planned. Appropriate treatment planning requires that the tumor be "staged" -- how far has the cancer spread? The major concern is whether or not a surgical approach is possible. There is general consensus that if the tumor has ventured beyond its original site, surgery is contraindicated.

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54 This is an operating room procedure (thoracotomy); it is classified in DRG 75: Major Chest Procedures.

Unfortunately lung cancer typically metastasizes early in its course, and many metastases are occult and asymptomatic. There are no patient complaints or physical findings to direct the metastatic work-up towards the most promising path. A shot-gun approach (in which every possible metastatic site is examined) may be taken. But this could involve numerous resources: surgeons to biopsy lymph nodes via mediastinoscopy; specialized radiologists to perform bone scans, liver scans, CT scans of the lung and brain; gastroenterologists to biopsy the liver; hemotologist/oncologists to biopsy the bone marrow.

Physicians vary in vigor with which they pursue the metastatic work-up. Some of this variability depends on the cell type of the cancer. In small cell cancer, for example, nearly every organ is a potential location for metastatic spread. Bone marrow aspiration and bone biopsy are frequently performed, even in the absence of symptoms, because one-fourth of patients have bone and marrow metastases. Some physicians would not perform a bone biopsy or aspiration if the primary cell type is non-small cell.

However, regardless of tumor type, there is considerable variability in physician practices. Some clinicians perform all of the blood imaging and biopsy techniques in the staging of each and every patient with a respiratory neoplasm. Other clinicians believe that many of these tests need not be performed routinely unless there are suggestive symptoms and signs. For example, if the blood liver function tests are normal, it is debatable whether a liver scan and liver biopsy should be routinely obtained. Similar controversies exist for the brain CT scan in patients without neurologic symptoms and bone x-rays and radioisotope bone scans for patients without bone pain.

Once metastatic work-up is concluded and therapy instituted, the diagnostic testing does not cease. Depending on the pattern of spread and the chosen approach to the cancer, physicians may or may not vigorously evaluate each new problem as it arises. If swallowing difficulties develop, a barium x-ray or endoscopic evaluation of the esophagus may be performed. If symptoms of meningitis or compression of the spinal cord develop, spinal punctures, myelograms and additional CT scans are often undertaken. Bronchoscopy, biopsies, scans and other tests must also frequently be repeated after a patient undergoes initial treatment to establish a subsequent therapeutic approach.

Thus, the initial evaluation of the lung cancer patient can be exceedingly costly. Multiple specialists may be required to perform their multiple procedures. Almost every patient must receive at least one diagnostic test to provide cells for pathologic exam. The approach following tissue diagnosis is highly variable, depending on several factors -- patient symptoms and attitudes, tumor type, physician practice styles, extent of metastatic and local spread. This could result in considerable variability in the costs of caring for the lung cancer patient. Finally, once diagnostic work-up is complete, it is likely that additional consultants must be contacted to guide planning of therapy. The therapeutic options in oncology are so technical and rapidly changing that it is unlikely that a general physician can keep track of them. Therapeutic issues are discussed below.

5.5 DIFFERENCES IN THERAPEUTIC APPROACH

Save for the fortunate few who present with surgically curable disease, patients with lung cancer have a grim prognosis. Even the most advanced therapies offer only limited chance of success. As in many areas where treatments are inadequate, research is continually offering new approaches. Different combinations of chemotherapeutic drugs, dosages, and schedules, and treatments with different combined modalities (e.g., radiation therapy plus chemotherapy) are repeatedly tried. There may be substantial regional and interinstitutional variablity and controversy engendered by these differing approaches, with a parallel heterogeneity of costs. But one of the most important sources of cost variability may be the paradox alluded to earlier in the severity section -- that care of the terminally ill patient may actually be cheaper than care of the less-affected patient.

Technology now has a tremendous ability to keep patients alive -- machines to help breathe, to help the heart pump. But many people now believe that there is a distinct trade-off between artificial prolongation of life and the quality of life. Individual patients and physicians differ on the values upon which they make this trade-off. Some patients want any and all treatments available to keep them alive. Others desire only to be kept comfortable and let the tumor take its course. These two different choices may generate substantially different costs.

One example involves the patient with mesothelioma. Although multiple different chemotherapeutic regimens have been tried, none have succeeded in significantly altering the course of the tumor. The only drug which shows even limited promise is adriamycin. However, adriamycin is notably cardiotoxic; it often leads to heart failure. Patients must be periodically monitored by radioisotope scans to evaluate heart function, and may be followed by a cardiologist as well as an oncologist. One patient may choose to pursue adriamycin therapy and be treated in the intensive care unit should his heart begin to fail. This patient opts for a coterie of specialists and multiple diagnostic tests. Another patient may choose to eschew treatment, prefering minimal intervention. Physician costs for this patient may be limited to the daily visit fee.

Thus, different approaches to the treatment of lung cancer may yield substantially different costs. Terminal care may be exceedingly costly if the patient chooses an aggressive posture towards his disease, including intensive care unit monitoring and the intervention of multiple specialists. Conversely, terminal care may prove inexpensive if the patient desires only to be kept pain free and comfortable. This paradoxical relationship of cost to severity of illness may actually be a common thread which wends through discussions of most cancers.

5.6 STATE DATA

As described in the preceding sections, lung cancer usually follows a fairly predictable clinical course. In its early stages it is often asymptomatic. As the disease progresses, the tumor may be locally destructive (e.g., block major airways) or it may metastasize widely, compromising other organ function. Does resource use in lung cancer patients follow a parallel natural history? The clinical perspective suggests several pecuniary possibilities. For example, an initial evaluative admission may be very expensive due to intensive use of diagnostic technologies. If medical treatment is planned (i.e., chemotherapy), subsequent admissions may be relatively cheap -- a patient enters for up to several days of intravenous cytotoxic drugs. Finally, once the tumor is widespread the patient may require prolonged hospitalization and intensive care unit (ICU) monitoring. Terminal stages of care may actually be cheaper if patients choose not to undergo heroic interventions.

If this clinical suspicion proves correct, one way to modify the respiratory neoplasms DRG may be to separate the patient population according to the natural history of the disease. As shown in Table 5.1, DRG 82 shows considerable heterogeneity in costs and length of stay. Perhaps part of this

TABLE 5.1

DRG 82 PART A AND B COSTS AND LENGTH OF STAY: MEANS AND COEFFICIENTS OF VARIANCE[a]

(N=3367 in New Jersey; N=2482 in North Carolina)

	PART A COST		PART B COST		LOS (DAYS)	
State	Mean	CV	Mean	CV	Mean	CV
New Jersey	$3,065	1.0320	$790	0.8400	14.31	0.9250
North Carolina	$2,469	1.2310	$477	1.0620	12.30	0.9080

a All New Jersey and North Carolina mean values are statistically significantly different at $p<.001$.

variability is due to grouping patients at different stages of their illness -- patients undergoing extensive diagnostic work-up, those given short courses of chemotherapy, medically unstable patients in the ICU, and terminally ill patients receiving "comfort only" measures. This state data section examines the possibility of subdividing DRG 82 by looking at the readmission issue.

DRG 82 included 3,367 admissions in New Jersey and 2,482 in North Carolina. However, a smaller number of patients account for all these admissions: 2,559 patients in New Jersey and 1,730 patients in North Carolina. This works out to 1.3 DRG 82 admissions per patient on average in New Jersey and 1.4 in North Carolina. If one looks even more broadly to incorporate all DRGs plus DRG 82, these 2,559 New Jersey patients accounted for 5,658 total admissions in 1982 (2.2 admissions per patient); the 1,730 North Carolina patients had 4,219 total admissions in 1982 (2.4 admissions per patient). These average admission per patient calculations obscure the broad range of numbers of admissions in both states. As shown in Figure 5.2, less than half of the patients had only one admission in 1982. The majority of patients had two or more admissions. Some patients had extraordinary numbers of admissions. Sixteen patients in New Jersey and 13 patients in North Carolina had 10 or more admissions in 1982.

However, most patients with multiple 1982 admissions were not initially admitted to DRG 82 (see Table 5.2). From the available data, it is impossible to determine whether these patients already carried the diagnosis of lung cancer. A smaller fraction of patients had a first admission to DRG 82 and subsequent admissions to DRGs other than DRG 82. The DRGs involved in the subsequent admissions were examined to assess a potential connection with lung cancer and its sequelae. No DRGs stood out as involving large numbers of patients. Once the DRGs were grouped into major diagnostic categories (MDCs), limited patterns arose (see Table 5.3). In both states, the largest groups of patients entered the respiratory disorder and poorly differentiated neoplasm categories (MDCs 4 and 17). Even so, about half the patients are spread across 20 other MDCs.[55]

Thus the focus narrowed to those patients with two admissions to DRG 82 -- 345 in New Jersey (13.5% of patients). (The analysis presented here is limited to New Jersey because comparable results were obtained in North Carolina.) The clinical expectation is that on average a first admission for diagnostic evaluation would be more expensive than an immediate subsequent admission for medical therapy. Because the data are limited to 1982, one

55 Given the generally progressive course of respiratory neoplasms, it is reasonable to assume that even though these patients were admitted to other DRGs, they continued to have lung cancer. Perhaps the second DRG is related to the cancer's widespread effects (brain metastases with seizures, bone metastases with pathologic fractures and spinal cord compression, liver metastases with liver failure and jaundice, for example). Whether or not to list the lung cancer as the principal diagnosis may be a question underlying potential "DRG creep."

TABLE 5.2

DRG ADMISSION PATTERNS FOR PATIENTS WITH

AT LEAST ONE ADMISSION TO DRG 82

	NEW JERSEY		NORTH CAROLINA	
Patients Who Had:	Number	Percent	Number	Percent
Only One Admission	1,027	40.1	597	34.5
Two or More Admissions				
At least two in DRG 82	345	13.5	266	15.4
One in DRG 82; prior admissions in another DRG, not DRG 82	785	30.7	627	36.2
One in DRG 82; subsequent admissions in another DRG, not DRG 82	402	15.7	240	13.9
Total Patients	2,559	100.0	1,730	100.0

TABLE 5.3

READMISSION MDC OF PATIENTS ADMITTED SUBSEQUENT TO AN ADMISSION IN DRG 82; EXCLUDES PATIENTS READMITTED TO DRG 82[a]

MDC Number	MDC Name	NEW JERSEY Number of Readmissions	NEW JERSEY Percent of Readmissions	NORTH CAROLINA Number of Readmissions	NORTH CAROLINA Percent of Readmissions
01	Diseases and Disorders of the Nervous System	45	6.3	28	6.0
02	Diseases and Disorders of the Eye	4	0.6	3	0.7
03	Diseases and Disorders of the Ear, Nose and Throat	9	1.3	9	1.9
04	Diseases and Disorders of the Respiratory System	166	23.2	116	24.8
05	Diseases and Disorders of the Circulatory System	52	7.3	42	9.0
06	Diseases and Disorders of the Digestive System	43	6.0	38	8.1
07	Diseases and Disorders of the Hepatobiliary System and Pancreas	16	2.2	6	1.3
08	Diseases and Disorders of the Musculoskeletal System and Connective Tissue	40	5.6	23	4.9

a 402 patients in New Jersey and 240 patients in North Carolina had two or more admissions, with a first admission in DRG 82 and a subsequent admission in another DRG. This table looks at the MDC of these subsequent admissions. The level of analysis for this table is the admission, not patient (a single patient could have had several subsequent admissions).

TABLE 5.3 CONTINUED

MDC Number	MDC Name	NEW JERSEY Number of Readmissions	NEW JERSEY Percent of Readmissions	NORTH CAROLINA Number of Readmissions	NORTH CAROLINA Percent of Readmissions
09	Diseases and Disorders of the Skin, Subcutaneous Tissue and Breast	10	1.4	9	1.9
10	Endocrine, Nutritional and Metabolic Diseases and Disorders	28	3.9	9	1.9
11	Diseases and Disorders of the Kidney and Urinary Tract	12	1.7	24	5.1
12	Diseases and Disorders of the Male Reproductive System	11	1.5	1	0.2
13	Diseases and Disorders of the Female Reproductive System	6	0.8	5	1.1
15	Newborns and Other Neonates with Conditions Originating in the Perinatal Period	0	0.0	1	0.2
16	Diseases and Disorders of Blood and Blood Forming Organs and Immunological Disorders	14	2.0	5	1.1
17	Myeloproliferative Diseases and Disorders, and Poorly Differentiated Neoplasms	144	20.1	119	25.5
18	Infectious and Parasitic Diseases (Systemic or Unspecified Sites)	6	0.8	10	2.2
19	Mental Diseases and Disorders	5	0.7	4	0.9
20	Substance Use and Substance Induced Organic Mental Disorders	0	0.0	1	0.2

TABLE 5.3 CONTINUED

		NEW JERSEY		NORTH CAROLINA	
MDC Number	MDC Name	Number of Readmissions	Percent of Readmissions	Number of Readmissions	Percent of Readmissions
21	Injuries, Poisonings and Toxic Effects of Drugs	3	0.4	5	1.1
23	Factors Influencing Health Status and Other Contacts with Health Services	3	0.4	2	0.4
	Unrelated OR Procedure, Invalid Discharge Diagnosis, Ungroupable	99	13.8	7	1.5
	TOTAL ADMISSIONS	716	100.0	467	100.0

cannot determine if the first admission is actually the first ever admission for lung cancer. Given this important caveat, the data are presented in Table 5.4 and Figure 5.3.

As shown in Figure 5.3, the percent of patients obtaining all physician services is higher in the first admission than in the second admission. This is especially true for two particularly important components of the initial evaluation, consultations and diagnostic surgery. Overall costs are also significantly greater in the first admission. When these costs are broken down into specific services, services oriented toward diagnosis and evaluation again show the most significant differences. Length of stay, however, did not provide important differences. Mean length of stay was 14 days for the first admission and 13 days for the second -- a statistically insignificant difference (t=1.30).

Thus, this preliminary crude analysis supports the clinical expectation that initial diagnostic admissions for evaluation of lung cancer may be more expensive than subsequent admissions for medical management. This difference may be attributed to intensive use of diagnostic technologies, both to evaluate the tumor itself and the extent of metastases. This pattern may hold true for other solid tumors as well. Therefore, it may be possible to subdivide oncologic DRGs into several stages (e.g., initial diagnosis, intermediate medical management, terminal care). These subdivisions may have more homogeneous costs.[56] This area may warrant further investigation.

5.7 IMPLICATIONS OF THE PROSPECTIVE PAYMENT SYSTEM FOR PHYSICIAN BEHAVIOR

As suggested in the clinical discussion and corroborated in the state data analysis, lung cancer patients may endure multiple admissions. The

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56 From the New Jersey data in Table 5.4, the CV for total physician costs is 0.6381 in the first admission and 0.8336 in the second admission. The overall Part B CV for New Jersey is 0.8400.

TABLE 5.4

COMPARISON OF FIRST AND SECOND ADMISSIONS FOR DRG 82, NEW JERSEY:

TOTAL PART B COST AND OTHER SPECIFIC PHYSICIAN COSTS[a]

(N=345)

Service	FIRST ADMISSION Mean Cost[b]	FIRST ADMISSION Number of Patients	SECOND ADMISSION Mean Cost[b]	SECOND ADMISSION Number of Patients	t-Test: Difference Between Mean Costs
Routine Hospital Visits: Attending MD	$294	345	$285	345	t=0.56; N.S.
Routine Hospital Visits: Other MDs	$92	141	$105	104	t=1.20; N.S.
ICU Visits	$147	179	$161	83	t=1.02; N.S.
Consultations	$128	242	$114	155	t=2.07; $p<.05$
Diagnostic Surgery	$380	179	$200	83	t=6.13; $p<.001$
X-Rays	$166	335	$117	317	t=3.59; $p<.001$
Other Tests	$83	314	$67	290	t=2.46; $p<.02$
Total Physician Cost	$862	345	$589	345	t=6.88; $p<.001$

a Adapted from Table 8-4 in Janet B. Mitchell *et al.*, *Creating DRG-Based Physician Reimbursement Schemes: A Conceptual and Empirical Analysis*, HCFA Grant No. 18-P-98387/1-01, October, 1984.

b The denominator for mean cost calculations is the number of persons who received the service.

Figure 5.2
Number of Admissions in 1982 for
Patients Admitted at Least Once
to DRG 82

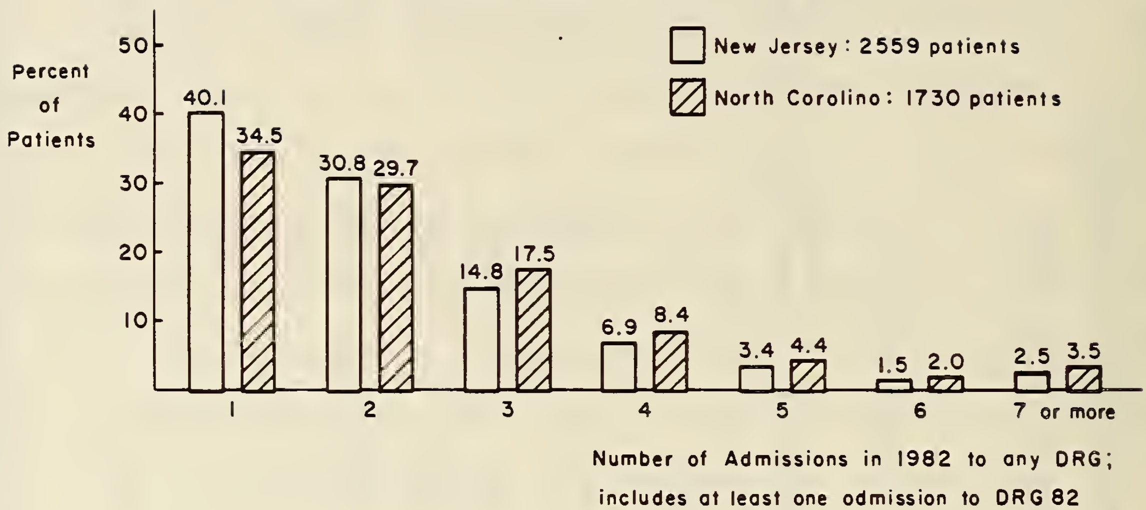
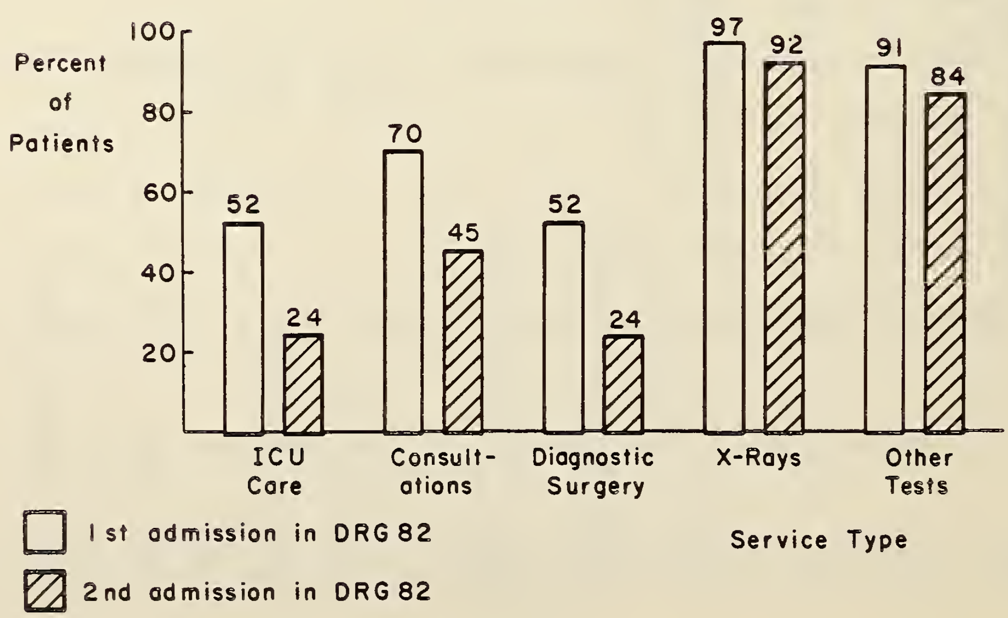


Figure 5.3
New Jersey: Percent of Patients
Obtaining Services in First and Second
DRG 82 Admission
N = 345



reasons and goals of these admissions, however, may be very different and may generate discrepant physician costs. Several different scenarios are possible. A patient may be admitted for:

1. Diagnostic Work-Up and Therapeutic Planning. This admission could involve multiple specialists and procedures. Depending on the course of the work-up (for example, if thoracotomy or mediastinoscopy become necessary), a patient may switch midstream to a surgical DRG.

2. Chemotherapy. This may entail a day or two of hospitalization. The only task required of the attending physician may be to write chemotherapy orders.

3. A Metastatic Complication. For example, the patient develops spinal cord compression due to a vertebral metastasis. This may require a specialist (e.g., radiation therapist), extra procedures, and emergent attention.

4. A Local Complication. For example, the tumor may erode into the esophagus or a local blood vessel, or a pneumonia may develop behind a blocked airway. Specialists and additional procedures may or may not be required.

5. Chronic General Complications. Cancer patients often lose their appetite and fail to eat properly, becoming dangerously underweight. Patients may be admitted for intravenous nutrition with long stays. The attending physician may be required only to provide his daily visit.

6. Terminal Care: Aggressive Approach. A critically ill patient may be admitted to the ICU, and multiple interventions may be taken to prolong life. This may prove very physician-costly.

7. Terminal Care: Palliative Approach. A critically ill patient may be admitted to a general medical floor, placed on a pain control regimen, and "comfort only" steps taken. This may not require significant physician costs.

Under the current single DRG for respiratory neoplasms, a physician would get paid the same amount for all types of admission. Yet all admissions would not entail identical physician costs. One may imagine that cheaper admissions may "subsidize" more costly admissions. For example, multiple chemotherapy admissions may compensate for the expense of the initial diagnostic hospitalization. But it is unlikely that costs for most patients would nicely average out (certain patients may receive the aggressive costly approach throughout their course). In addition, perverse incentives may arise. For example, many hospitals are now supporting ambulatory chemotherapy units to take the place of the short "in and out" admission. A DRG system may encourage physicians to revert to this admission practice to cross-subsidize other expenses.

This lung cancer example highlights one of the most difficult ethical dilemmas confronting the physician under the PPS. If patient care choices directly influence the physician's income and thus well-being, how does this affect the services offered patients? For example, a hopeful, new therapy is unfortunately very expensive. The physician could argue that it is "only experimental," and thus not offer it to his patients. Another physician could decide that, because there are no cures and only short-term therapies with dangerous side effects, it is ethical to recommend only palliative options to his patients. However, the patient may have preferred an aggressive posture. These are very complex issues, treading on ethical concerns which perhaps only society should address. In fact, placing the physician in the role of making these trade-offs may be inappropriate and undesirable. These concerns are addressed in Section 10.9.

Other practice modifications may more minimally affect patient care. For example, portions of the initial and metastatic work-up could proceed on an ambulatory basis. Consultations may be received as an outpatient. If a physician feels that the patient may eventually require thoracotomy to establish diagnosis, he may recommend skipping the more benign procedures (e.g., bronchoscopy) and jumping directly to surgery. Physicians may also decide to limit the metastatic work-up to symptomatic and high-probability sites. General physicians may choose to transfer primary attending responsibility for these expensive patients to specialists. The specialists must then run the financial risks.

One final implication involves the manipulation of diagnoses, or "DRG creep." There may be two opportunities for creep: (1) because lung cancer causes many complications and metastasizes widely, patients could be coded in a DRG pertaining to that complication or metastasis; and (2) DRG 82 incorporates metastatic disease from malignancies in other organs (which may have lower reimbursement levels). DRG 82 has a current hospital relative weight (R.W.) of 1.1400.[57] Two examples of the first "creep" technique are as follows:

1. A patient develops spinal cord compression due to lung cancer metastatic to a vertebra. He may be assigned to DRG 9: Spinal Disorders and Injuries with a R.W. of 1.3958.

2. A patient develops a staphlococcal pneumonia related to his lung cancer. He may be assigned to DRG 79: Respiratory Infections and Inflammations Age>69 and/or C.C. with a R.W. of 1.7982.

The second type of creep involves numerous instances: in some cases it is most profitable to assign the patient to the DRG relating to the primary malignancy; in others it is best to emphasize the lung metastases. Several examples are as follows (DRG 82 R.W.=1.1400):

1. A patient with colon cancer has lung metastases. DRG 172: Digestive Malignancy Age > 69 and/or c.c. has a R.W. of 1.2268.

2. A patient with breast cancer has lung metastases. DRG 274: Malignant Breast Disorders Age > 69 and/or c.c. has a R.W. of 1.0108.

3. A patient with kidney cancer has lung metastases. DRG 318: Kidney and Urinary Tract Neoplasms Age > 69 and/or c.c. has a R.W. of 0.8142.

4. A patient with testicular cancer has lung metastases. DRG 346: Malignancy, Male Reproductive System, Age > 69 and/or c.c. has a R.W. of 0.9395.

5. A patient with uterine cancer has lung metastases. DRG 366: Malignancy, Female Reproductive System Age > 69 and/or c.c. has a R.W. of 0.8444.

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57 "Rules and Regulations," Federal Register 48 (September 1, 1983): 39876-39886.

6. A patient with lymphoma has lung metastases. DRG 403: Lymphoma or Leukemia Age > 69 and/or c.c. has a R.W. of 1.1715.

Thus, inclusion of lung metastases in DRG 82 invites this type of diagnostic manipulation.

5.8 SUMMARY AND CONCLUSIONS

Lung cancer is a leading cause of death and disability among elderly Americans. In most cases, it is an incurable disease; current medical therapies generally offer only limited hope for success. They often fail to curb the natural course of the disease -- local invasion and metastatic spread. Thus, in the interval from diagnosis through death, the lung cancer patient may have many hospitalizations. The New Jersey and North Carolina Medicare data confirm this clinical expectation. Less than half of the lung cancer patients had only one admission in 1982. The majority of patients had two or more admissions in multiple DRGs.

The Part B CVs for DRG 82 were 0.8400 in New Jersey and 1.0620 in North Carolina. The clinical analysis may suggest possible sources of this variability. First, DRG 82 groups together multiple clinical entities. It includes not only all forms of primary lung cancer (different types of lung cancer have distinct biologic behaviors and implications for resource use), but also incorporates secondary tumors metastatic to the lung. The lung is a popular site for spread of multiple malignancies -- sarcoma, lymphoma, melanoma, as well as breast, colorectal, prostate, ovarian, testicular, uterine, and other cancers. Thus, many different clinical presentations are involved. In the 1982 Medicare data, metastatic disease accounts for 16.7% of cases in New Jersey and 11.3% of cases in North Carolina.

Second, DRG 82 incorporates all lung cancer, regardless of spread or comorbidity. In many instances, severity may be positively correlated with cost. But lung cancer may also offer a paradox. Costs at initial detection may be extremely high, while costs of palliative terminal care may be very low. Third, numerous resources may be mobilized to evaluate and treat lung cancer patients. Use of these resources may vary widely depending on a number of factors -- ease of diagnosis, exact type of tumor, physician training and approach, and patient attitudes. This fourth factor leads into a final reason for cost variability: the different degrees of vigor with which treatment can be pursued. Some patients may opt for an aggressive stance whereas others prefer to avoid heroic measures. These different attitudes may translate into extremely different physician costs.

The lung cancer patient may have many different types of admissions, with different cost implications. In most instances, the initial hospitalization may be very costly because of efforts to establish definitive diagnosis and design the treatment plan. The New Jersey Medicare data were used to explore this issue. Although one cannot tell from the available data whether the first 1982 DRG 82 admission is the first admission ever for lung cancer, the first admission was significantly more costly than the second. Services oriented toward diagnosis and evaluation showed the most significant differences. This pattern may also hold true for other solid tumors. Therefore, it may be possible to subdivide oncologic DRGs into several stages (e.g., initial diagnosis, intermediate medical management, terminal care), that may have more homogeneous costs.

Using DRG 82 for reimbursing physicians who care for lung cancer patients may hold implications which are similar to those for hospitals:

1. Diagnostic Work-Up. Hospitals have an incentive to minimize the extent of diagnostic work-up. Once tissue type is firmly established, physicians may have the same incentive (e.g., minimizing metastatic work-up).

2. Earlier Diagnostic Surgery. If thoracotomy may be eventually required, hospitals have an incentive to encourage performance of the operation as early as possible. Physicians may have the same

incentive. This may mean that a group of patients who could have been diagnosed using bronchoscopy would receive the more costly and risky surgery.

3. Work-Up Setting. Hospitals have an incentive to shift expensive tests from an inpatient to an outpatient setting. Physicians would have the same incentive, particularly in encouraging outpatient consultations with a specialist.

4. Split Admissions. Hospitals have an incentive to discharge stable medical patients and readmit them for surgical procedures. Physicians may have the same incentive.

5. Case Mix. Hospitals have an incentive to admit "easy" cases. Physicians may have the same incentive, particularly with the short-stay chemotherapy patients.

6. Therapy. Hospitals have an incentive to provide the least expensive acceptable therapy. Physicians may have the same incentive.

7. DRG Creep. Hospitals have an incentive to assign patients to the most lucrative potential DRG. Physicians have the same incentive.

However, implicit in these speculations is a premise which may not be correct -- that the major motivation of physicians is to maximize income. In fact, most physicians may strive first for the intangible ethic of providing the best possible care for each individual patient. Historically cancer cases have highlighted many ethical dilemmas in medicine; this instance is no exception. Many important questions are raised. Should societal resource constraints have an impact on individual patient care decisions? What should the physician do if he sincerely believes that the experimental but very expensive therapy is best for his patient? Should palliation alone be the uniform goal of care in incurable cases? Or should physicians accede to narrow hopes and the desire to simply prolong life at higher cost? Placing the physician in the position of choosing between a patient's needs or desires and society's goals may be inappropriate and undesirable. The impact of this factor must be considered as the reimbursement system is designed.

Chapter 6

ATHEROSCLEROSIS: MEDICAL DRGS

DRG 132: Atherosclerosis Age > 69 and/or c.c.

DRG 133: Atherosclerosis Age < 70 w/o c.c.

6.1 INTRODUCTION

One of the goals of the DRG designers was to create clinically comprehensible categories.

> It must be interpretable medically, with subclasses of patients from homogeneous diagnostic categories. That is, when the patient classes are described to physicians, they should be able to relate to these patients and be able to identify a particular patient management process for them.[58]

However, certain trade-offs were required to satisfy the practical goals of minimizing the number of groupings and enhancing the homogeneity of as many categories as possible. To achieve these additional goals particular DRGs by default became "miscellaneous" categories by incorporating ICD codes which did not fit into the more homogeneous DRGs. From the clinical perspective, this appears to have been the case for the atherosclerosis DRGs.

Atherosclerosis is a pathologic process affecting major arteries. It is a disease of aging in Western society. Cardiovascular disease, one of the consequences of atherosclerosis, is the major killer of persons in the United States. Therefore, atherosclerosis is a process with which most physicians are exceedingly familiar. However, if one were to say to a physician, "Mr. Smith has atherosclerosis," it would be difficult for a physician to "relate" to this statement. Almost all American males have some atherosclerosis once they reach middle age, but what does this mean clinically? Is he asymptomatic, as most persons with atherosclerosis clearly

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58 Robert B. Fetter et al., "Case Mix Definition by DRGs," Medical Care 18 Supplement (1980): 5.

are? Does he have crippling claudication, incapacitating angina, or TIAs? Thus a DRG entitled merely "Atherosclerosis" is not necessarily "interpretable medically." Once one delves into the ICD codes comprising these DRGs, the definitional issues become even less clearcut.

However, given the prevalence of atherosclerotic diseases, it is not surprising that these DRGs have large Medicare caseloads: 3,124 cases in New Jersey and 8,587 in North Carolina. Costs are proportionately high, with total expenditures of $10,713,039 in New Jersey and $21,177,479 in North Carolina. What is most striking is the magnitude of the variation within these DRGs and the disproportionately large Part B CVs (see Table 6.1). These are among the few high volume DRGs where Part B variation appears sytematically greater than Part A variation.

TABLE 6.1

VARIATION WITHIN ATHEROSCLEROSIS DRGS

	New Jersey		North Carolina	
	DRG 132	DRG 133	DRG 132	DRG 133
Part A CV	1.4390	1.2690	1.1360	1.1400
Part B CV	1.3030	1.8830	1.2770	1.4420

These high variations are not surprising given the poor definition of these DRGs. However, the disproportionately high Part B variances are worrisome from the individual physician perspective, where the protection of the law of large numbers falters. Because these DRGs have such large caseloads, it is likely that most physicians treating Medicare patients will at some point encounter these risks.

This chapter explores the atherosclerosis DRGs as the prototype for those clinically "miscellaneous" DRGs. Since the definitional issues predominate, the focus is on the next section, "Definitional Precision." As will become apparent, the clinical characteristics of patients within these DRGs are not at all obvious given the poor specificity of the ICD codes. Therefore, the ensuing sections on severity of illness, discretionary resources, and therapeutic differences are more limited.

6.2 DEFINITIONAL PRECISION

The circulatory disorders (MDC 5) medical DRGs present a confusing array of nomenclature. The DRGs and their respective ICD codes reflect symptoms, events, clinical diagnoses, and pathologic processes without clear recognition that these are not necessarily mutually exclusive categories -- a patient could simultaneously have a symptom, diagnosis, and pathologic process. For example, DRG 143: Chest Pain connotes a patient's chief complaint. DRG 140: Angina Pectoris suggests a diagnosis; angina usually presents as chest pain. DRGs 132 and 133: Atherosclerosis represent the pathologic process which often precipitates the clinical syndrome of angina pectoris. At what level should the patient be categorized? At the level of symptom, diagnosis, or pathologic process? Finally, DRG 129: Cardiac Arrest signifies a clinical event, not a diagnosis or pathologic process. The patient may have chest pain, angina, and atherosclerosis, but does the lethality of that clinical event, cardiac arrest, mean that it supercedes these other levels of categorization?

A clinical example of this problem of mixed nomenclature is as follows:

> A 65 year old man was brought to the emergency room after an hour of left chest and arm pain which had started following a heavy lunch. He had experienced such discomfort before, usually during exercise, but it had always resolved with rest. He had attributed it to "being out of shape"; he was moderately obese and a smoker. In the ER, his ECG did not show clearcut evidence of myocardial ischemia, but the pain resolved

after several sublingual nitroglycerin tablets. To be safe, he was admitted to the hospital on a "Rule Out Myocardial Infarction" protocol which involved CCU monitoring and checks of his cardiac enzymes. However, he now felt fine, and being in the CCU made him exceedingly nervous. He decided to leave against medical advice before the blood test results returned.

What should be the principal diagnosis in this patient? The following are several possiblities:

1. "Suspected Cardiovascular Disease." Dr. A is diagnostically conservative. Although the patient gave a reasonable history and had the risk factors for cardiovascular disease, he is unwilling to make a firm diagnosis until further tests were performed (e.g., exercise tolerance test). The ICD code is V7170, and the DRG is 143, <u>Chest Pain</u>.

2. "Angina Pectoris." Based upon the history, risk factors, and emergency room information, Dr. B makes a clinical diagnosis of angina pectoris. The ICD code is 41390, and the DRG is 140, <u>Angina Pectoris</u>.

3. "Atherosclerotic Heart Disease." Dr. C also thinks the patient has angina. Given the history and risk factors, he is sure the angina is based upon coronary artery disease. The ICD code is 41400, and the DRG is 133, <u>Atherosclerosis</u>.

4. "Rule Out Myocardial Infarction." Dr. D concedes that the patient's excellent response to nitroglycerin makes a heart attack unlikely, but he would like to see the results of the blood tests before he commits himself in the patient record. He therefore equivocates and lists this "diagnosis." The ICD code is 41090, and the DRG is 122, <u>Circulatory Disorders with AMI w/o C.V. Complication, Discharged Alive</u>.[59]

Thus, some confusion may arise from mixing these different sets of terminology. Atherosclerosis, the pathologic process, may underlie the

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59 Physicians often adopt this "rule out" terminology to reflect the goal of a planned diagnostic work-up. Medical record coding procedures stipulate that such a "rule out" condition be coded as if it really exists. Following is an excerpt from the section on suspected conditions from the Basic Coding Principles chapter*:

> If the diagnosis at the time of discharge is stated as "suspected," "questionable," "likely," "?," and so forth, code the condition as if it existed or was established.
>
> If the discharge diagnosis is stated as "rule out...," it is to be interpreted as "suspected."

* <u>ICD-9-CM Coding Handbook for Entry-Level Coders</u>, Chicago: American Hospital Association, 1979, p. 58.

condition in the majority of cases in 19 of the 25 medical DRGs in this major diagnostic category. In many instances the clinical diagnosis (e.g., acute myocardial infarction) appears to supercede the patholgoic (i.e., atherosclerosis of the coronary arteries). But in other cases, the ordering may not be so clear cut.

Although this problem seems particularly obvious in the case of the DRGs, the looseness of terminology has been noted in the field of vascular diseases for many years. Technically the term atherosclerosis refers to a plaque containing mainly cholesterol and covered by a fibrous cap in the innermost layer of large and medium-sized muscular arteries (coronary arteries, carotids, arteries of the legs) and the large elastic arteries (aorta, iliac vessels).[60] These plaques may become "complicated" as the process progresses. They may become calcified, yielding an eggshell-like brittleness to the involved vessel; they may ulcerate discharging debris which may block smaller vessels downstream; a clot, or thrombus, may develop, occluding the vessel; or they may weaken the vessel wall so much that an aneurysm may arise, with risk of rupture. Atherosclerosis becomes more severe as the patient ages.

The distinction between this pathologic process and the resultant clinical syndromes has become blurred by loose usage of the terminology.

> It is important to emphasize that atherosclerosis is often used not only to describe the characteristic arterial lesions of this disease but also the accompanying symptoms resulting from secondary ischemia and necrosis of vital organs. This generic use of the term is often inaccurate and confusing. Although atheromatous lesions are exceedingly common in the middle-aged population of developed countries, the arteriopathy often does not progress to the stage where clinical symptoms are induced. In some patients it may remain undetected for many years.[61]

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60 Stanley L. Robbins and Ramzi S. Cotran, Pathologic Basis of Disease, Philadelphia: W. B. Saunders Company, 1979, p. 598-604.

61 Abel L. Robertson, "The Pathogenesis of Human Atherosclerosis," in Antonio M. Gotto et al., eds., Atherosclerosis, Kalamazoo: The Upjohn Company, 1977, p. 38.

In other words, by pathologic exam most of the the Medicare population has atherosclerosis, but only a subset have clinical symptoms. What, then, are the atherosclerosis DRGs?

It is interesting to note that the atherosclerosis DRGs do not include the ICD codes which are entitled "Atherosclerosis" (44000 through 44090). These are subsumed under DRGs 130 and 131, Peripheral Vascular Disease. They also do not include a favorite site of atherosclerosis -- the cerebral vessels. The atherosclerosis DRGs focus mainly on cardiac disease. Ironically, they include certain ICD codes which target disorders that may in fact not be at all related to coronary artery disease and atherosclerosis. At this point it may be helpful to look individually at the 11 ICD codes which comprise DRGs 132 and 133:

> Code 41200. Old Myocardial Infarction. "Healed myocardial infarction; past myocardial infarction diagnosed on ECG or other special investigation, but currently presenting no symptoms."[62] It is difficult to imagine why this is a justifiable reason for hospitalization, but it is one of the top five diagnoses in North Carolina.
>
> Code 41400. Coronary Atherosclerosis. This is a pathologic diagnosis. Patients with atherosclerosis in their coronary arteries could be asymptomatic, or could have severe angina and myocardial infarction.
>
> Codes 41480 and 41490. Chronic Ischemic Heart Disease NEC and NOS. All these codes say is that the blood flow to the heart is impaired; once again the patient could have a range of clinical manifestations.
>
> Code 42920. Cardiovascular Disease, Unspecified. "Arteriosclerotic cardiovascular disease." The issues are the same as for 41400 above.
>
> Code 42930. Cardiomegaly. "Cardiac dilatation, hypertrophy; excludes that due to hypertension." Cardiomegaly means "large heart." The heart may enlarge due to repeated infarctions, but other common reasons are valvular disease and cardiomyopathy due to viral illness, alcohol abuse, and a large number of causes unrelated to atherosclerosis.
>
> Code 42989. Other Ill-Defined Heart Disease. "Carditis." Carditis means "inflammation of the heart." It is usually caused by an infectious agent; Coxsackie B virus is most commonly implicated in the United

62 Definitions of ICD codes obtained from The International Classification of Diseases 9th Revision Clinical Modification, U.S. Department of Health and Human Services (PHS) 80-1260, 1980.

States. Other causes include toxin, drug, and radiation exposure, but carditis is generally unrelated to atherosclerotic disease.

Code 42990. Heart Disease, Unspecified; Code 45990 Unspecified Circulatory System Disorder. These are catch-all codes which could mean virtually anything.

Code 45989. Other Specified Disorders of Circulatory System. "Collateral circulation (venous), any site; Phlebosclerosis; Venofibrosis." This code has nothing to do with arterial disease and atherosclerosis. Its focus is the venous system, which presents a very different clinical picture.

Code 79320. Nonspecific Abnormal Findings on Radiological and Other Examination of Body Structure: Other Intrathoracic Organ. "Abnormal echocardiogram, heart shadow, ultrasound cardiogram; mediastinal shift." Once again, this code could mean virtually anything, from atherosclerotic heart disease to tumors of the thymus gland.

From reviewing the ICD codes which make up the atherosclerosis DRGs, it becomes clear that DRGs 132 and 133 are clinically "wastebasket DRGs." They include codes which do not fit well with the other, more precisely defined DRGs in the major diagnositc category. Thus, by default they are definitionally imprecise, in a conscious trade-off to enhance the homogeneity of the other DRGs. However, as discussed earlier, patients with one of these ICD codes representing a pathologic process (e.g., Code 41400, Coronary Atherosclerosis) could just as easily receive a code representing a clinical diagnosis (e.g., Code 41390, Angina Pectoris). This latter code would reassign the patient to the angina DRG 140. What coding styles are practiced by New Jersey and North Carolina?

The two states appear to use the atherosclerosis DRGs very differently. Table 6.2 lists 13 DRGs which may represent patients who have atherosclerotic coronary artery disease. This involves 45,791 cases in New Jersey and 34,040 in North Carolina. Of these cases, the proportion assigned to the atherosclerosis DRGs (132,133) are very different: 6.8% of cases in New Jersey and 25.2% of cases in North Carolina. The proportions allotted to DRG 140: Angina Pectoris are also somewhat different: 20.7% in New Jersey

TABLE 6.2

MDC5 MEDICAL DRGS WHICH MAY RELATE TO ATHEROSCLEROTIC HEART DISEASE

DRG Number	DRG Name	NEW JERSEY Number of Cases	NEW JERSEY Percent	NORTH CAROLINA Number of Cases	NORTH CAROLINA Percent
121	Circulatory Disorders with AMI and C.V. Comp: Disch. Alive	2,767	6.0	0	--[a]
122	Circulatory Disorders with AMI w/o C.V. Comp: Disch. Alive	4,735	10.3	4,755	14.0
123	Circulatory Disorders with AMI: Disch. Dead	1,256	2.7	1,129	3.3
124	Circulatory Disorder Exc AMI with Cath and Complex Dx	1,028	2.2	16	--
125	Circulatory Disorder Exc AMI with Cath w/o Complex Dx	495	1.1	98	0.3
127	Heart Failure and Shock	15,964	34.9	7,711	22.7
129	Cardiac Arrest	268	0.6	333	1.0
132	Atherosclerosis Age > 69 and/or c.c.	2,427	5.3	6,053	17.8
133	Atherosclerosis Age < 70 w/o c.c.	697	1.5	2,534	7.4
138	Cardiac Arrhythmia and Conduction Disorder Age > 69 and/or c.c.	4,315	9.4	3,788	11.1
139	Cardiac Arrhythmia and Conduction Disorder Age < 70 w/o c.c.	1,158	2.5	1,332	3.9
140	Angina Pectoris	9,488	20.7	4,547	13.4
143	Chest Pain	1,193	2.6	1,744	5.1
		45,791	99.8[b]	34,040	100.0

a North Carolina 1982 data does not include secondary diagnosis. Thus no patients have been assigned to this DRG.
b [illegible]s n[illegible]dd [illegible] 00. [illegible]ue [illegible]rou[illegible]g.

and 13.4% in North Carolina. Finally, twice as many patients proportionately were assigned to DRG 143: Chest Pain in North Carolina (5.1%) as in New Jersey (2.6%).[63] Thus it appears that North Carolina patients are much more likely to receive a "pathologic" diagnosis (atherosclerosis) while New Jersey patients are more likely to receive a clinical diagnosis (angina, heart failure).

Within DRGs 132 and 133, the two states are actually very similar with respect to the ICD codes used (see Figure 6.1). Coronary atherosclerosis (Code 41400) and chronic ischemic heart disease, unspecified (Code 41490) are the most popular codes. One difference is North Carolina's use of Code 41200, Old Myocardial Infarction. It is used in 94 cases in DRG 132 and 58 cases in DRG 133. Yet, as that ICD code is defined, it refers to asymptomatic patients. Why are these persons admitted to the hospital?

6.2.1 Chart Review

As emphasized in the previous section, a diagnosis such as "coronary atherosclerosis" is a pathologic diagnosis. It says little about the symptoms or severity of the illness which drove the patient into the hospital. Who are these patients? In an effort to answer this question, a chart review was performed as follows:

> The Medical Records Department at University Hospital (a 379-bed, tertiary care hospital affiliated with Boston University School of Medicine) was asked to provide the records of all patients with one of the eleven ICD codes within DRGs 132 and 133 as principal discharge diagnosis discharged during the twelve months, ending September 30, 1984. Only 47 such records were identified.[64] Twenty-two of these records were reviewed by the Assistant Director of the Medical Records Department to

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63 Another striking difference is the percentage of patients assigned to DRG 127: Heart Failure and Shock: 34.9% in New Jersey and 22.7% in North Carolina.

64 This is a relatively small number given the large volume of cardiovascular cases seen at University Hospital. This suggests that the coding practices at University Hospital steer away from these particular codes, much as appears to be the trend in New Jersey.

Figure 6.1A
Five Most Common ICD Diagnoses
in DRG 132

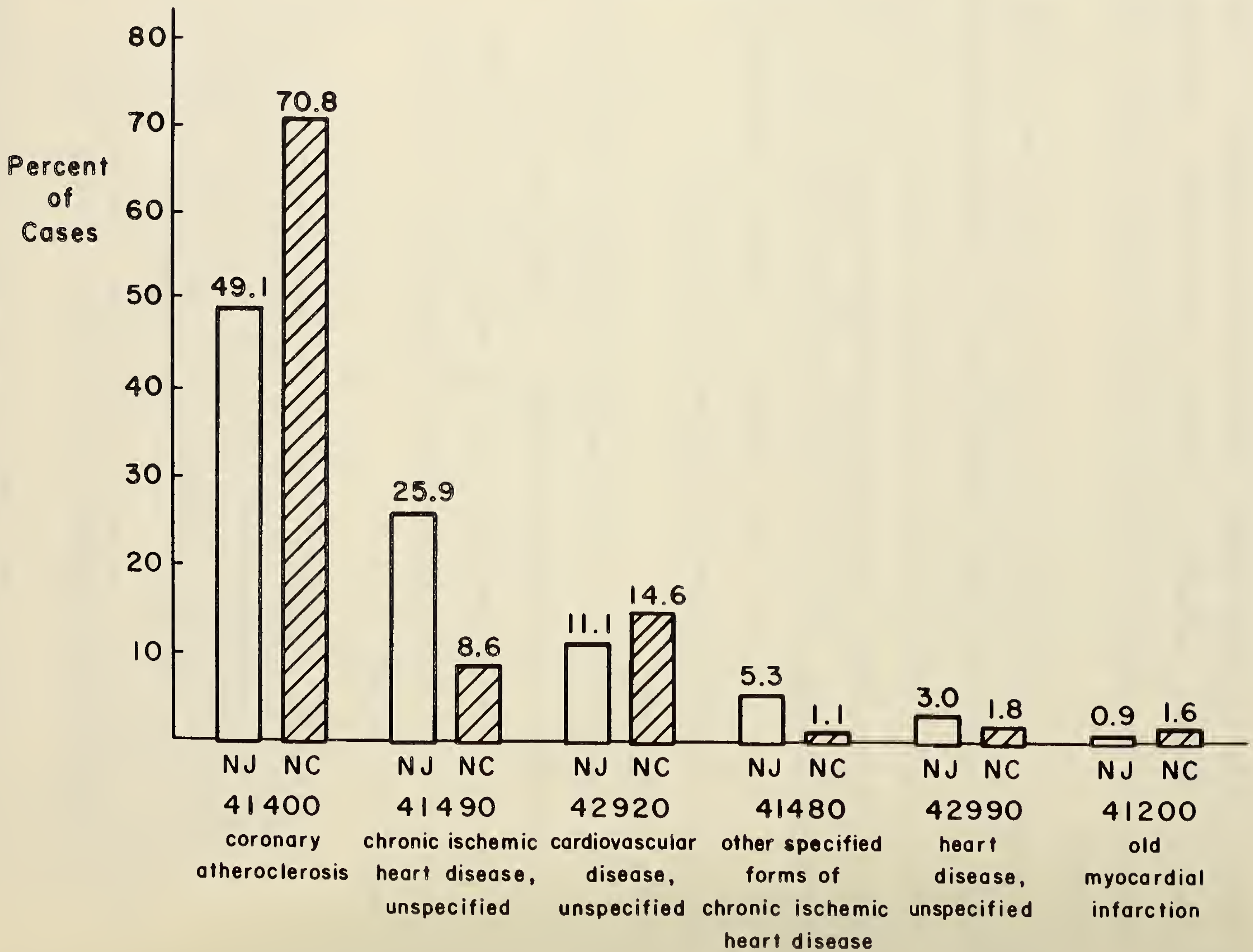
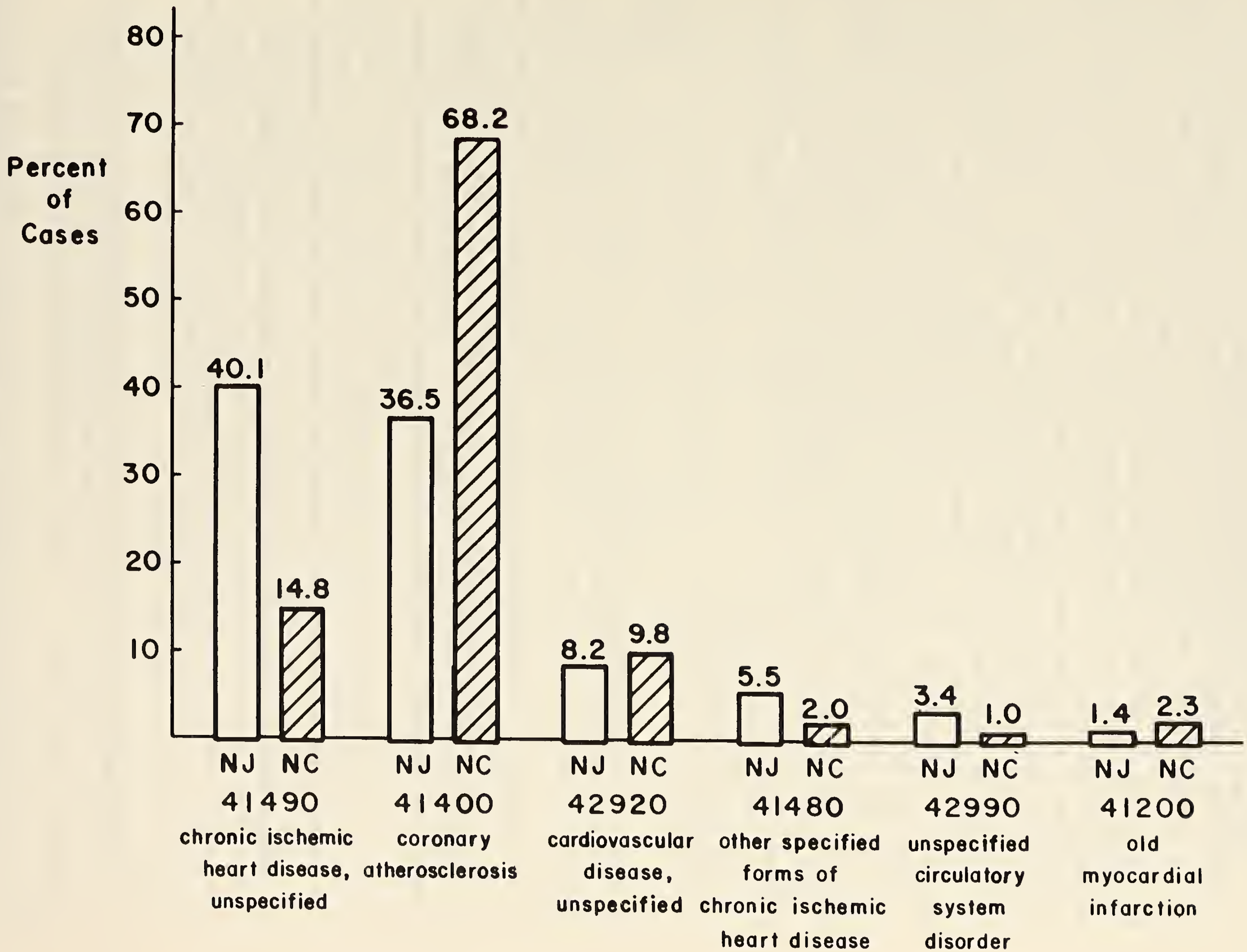


Figure 6.1B
Five Most Common ICD Diagnoses
in DRG 133



ascertain the correctness of the ICD code assignment. She agreed with the original coder's decision in all but five cases. The same 22 records were reviewed by a physician both experienced in chart review and the director of the Quality Assurance Program.

A clear pattern emerged from perusal of these records. Most of these patients (18 of 22) were admitted because of chest pain, often to rule out myocardial infarction. None had actually had an infarction, or else they would have been assigned a specific infarction ICD code. Several had long-standing symptomatic coronary artery disease, with or without past myocardial infarction. Many were admitted because of new or progressive angina, for the specific purpose of having coronary angiography or angioplasty (having already had angiographic studies confirming coronary artery disease).[65] The clinical diagnosis for almost all of these patients is therefore angina pectoris.

The type of "diagnosis" to assign a patient (symptom versus clinical diagnosis versus pathologic diagnosis) appears to depend very much upon physician interpretation and record room practice. If a diagnostic procedure which documents the presence of coronary atherosclerosis is performed during an admission, the atherosclerosis may be used as the principal discharge diagnosis. However, the patient who has previously had such studies and who comes into the hospital with similar chest pain is more likely to receive a discharge diagnosis of angina pectoris. But a sort of double standard exists. If the patient who received the diagnostic procedure also ruled <u>in</u> for a myocardial infarction, the infarction supercedes the coronary atherosclerosis as the principal discharge diagnosis.

At University Hospital, the medical records staff appear to exercise considerable discretion in assigning diagnosis codes, basing their

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65 If the patient actually received these procedures, they would be assigned to one of the catheterization DRGs (124 or 125). It is interesting to note that a number of these patients had their procedures cancelled after entering the hospital.

determination upon review of the entire chart. They thus take into account all medical comments, opinions, and data, following guidelines and decision rules from the national and international coding systems. However, many other institutions do not base their coding decisions upon this very resource intensive complete record review. What the physician lists in the discharge summary is accepted as an adequate representation of the patient's condition. Thus the code is based upon the vagaries and idiosyncracies of the way individual physicians determine discharge diagnosis. This process is not taught in medical school or post-graduate training, and it is practiced with varying degrees of interest and precision. Physicians often pay little attention to the phrasing of discharge diagnoses, listing such "non-diagnoses" as "rule out myocardial infarction."[66] Therefore, diagnostic codes are dependent upon individual physician behaviors and institutional and regional differences.

In summary, DRGs 132 and 133 in specific and the cardiovascular DRGs in general raise a number of definitional issues:

1. The cardiovascular DRGs are defined using shifting criteria -- symptoms, clinical diagnoses or events, pathologic processes -- yielding a confusing array of categories which are conceptually not mutually exclusive (i.e., a patient with coronary atherosclerosis may also have chest pain and angina).

2. A number of ill-defined and inconsistent decision rules appear to drive patients into one cardiovascular DRG or another; these rules may be different for different physicians, hospitals, and regions. For example, a patient with documented coronary artery disease may receive a diagnosis of atherosclerosis (in North Carolina) or angina (in New Jersey). But if that patient also had a myocardial infarction due to atherosclerosis, the myocardial infarction would supercede the atherosclerosis.

3. The ICD code determination itself is dictated by individual physician practices and medical record room approaches. The quality of this information is thus highly variable.

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66 As mentioned earlier, medical records coding convention stipulates that a "rule out" be coded as if the condition actually exists.

4. The ICD codes comprising DRGs 132 and 133 are extremely non-specific and ill-defined (7 of the 11 codes are NEC and NOS codes). A number of the codes deal with conditions generally unrelated to atherosclerotic disease. Thus, almost by definition, these are clinically "wastebasket" DRGs.

Certainly a number of these issues may partially resolve as the prospective payment system is further implemented. Physicians may become more careful in their choice of discharge diagnosis; pecuniary incentives may clarify the decision rules driving the DRG assignment of patients. For example, the relative weight of DRG 140: Angina Pectoris is 0.7548 while for DRG 133 it is 0.8599 and for 132, 0.9182.[67] Since most patients with angina also have coronary atherosclerosis (ICD Code 41400), it is medically totally reasonable to list this as the principal diagnosis. Since one gets paid more for the atherosclerosis DRGs, there would appear very little reason to categorize any patient within the angina group.

Thus, because of the way these cardiovascular DRGs are defined (i.e., from a medical standpoint, the groups are not mutually exclusive), there is ample room for manipulation. It is also not surprising that there should be so much variability within these DRGs. The best way to solve these problems may be to step back and redefine the parameters along which patients are to be grouped. It may be that a different grouping strategy may address some of these concerns.

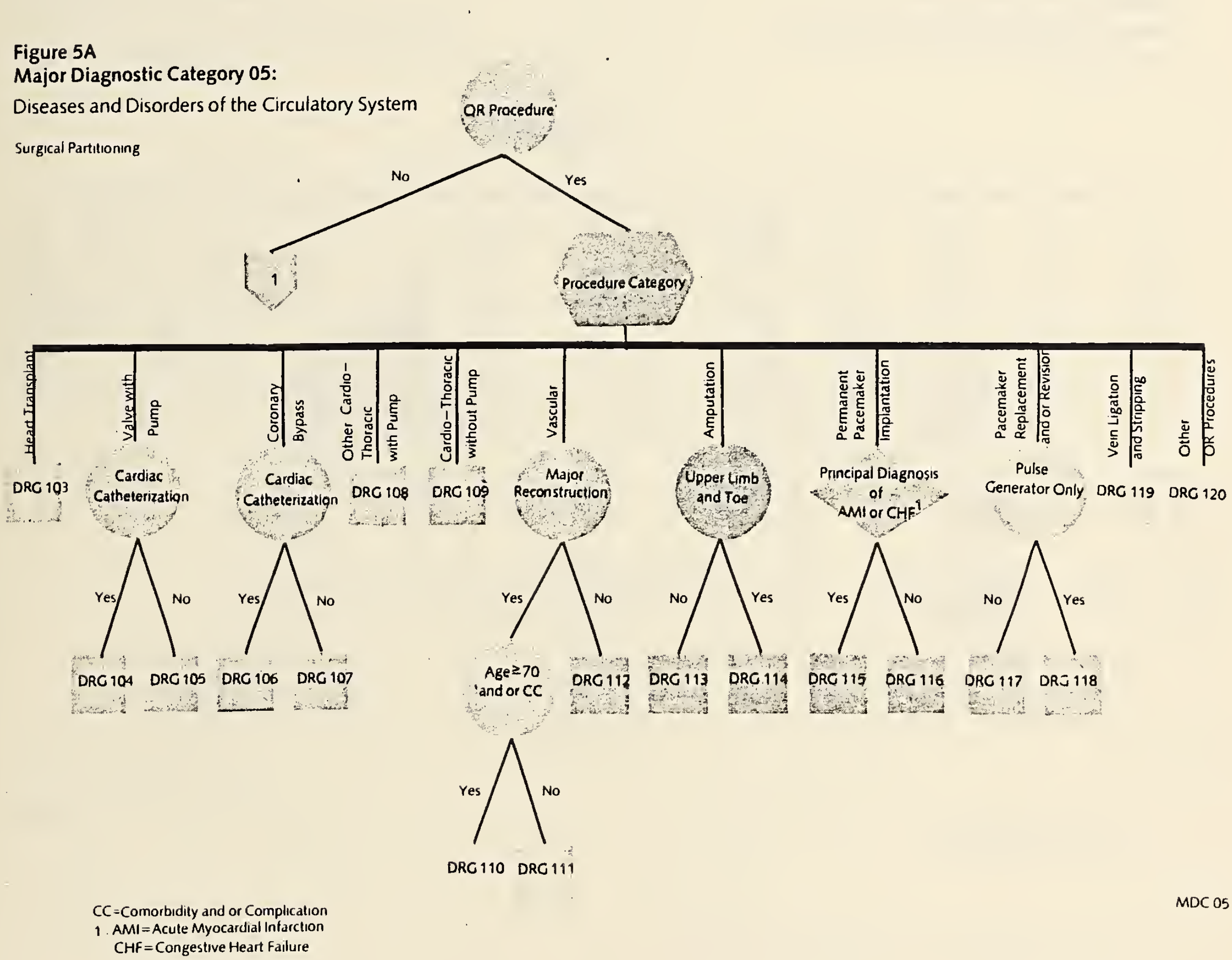
6.3 SEVERITY OF ILLNESS

Perhaps more than any other major diagnostic category, the circulatory disorder major diagnostic category confronts the issue of severity of illness head-on. The decision tree underlying DRG assignment is reproduced as Figure 6.2. The first branching point depicts whether or not an acute myocardial infarction (AMI) occurred. If so, lower branches represent whether

67 "Rules and Regulations," Federal Register 48 (September 1, 1983): 39876-39886.

FIGURE 6.2[a]

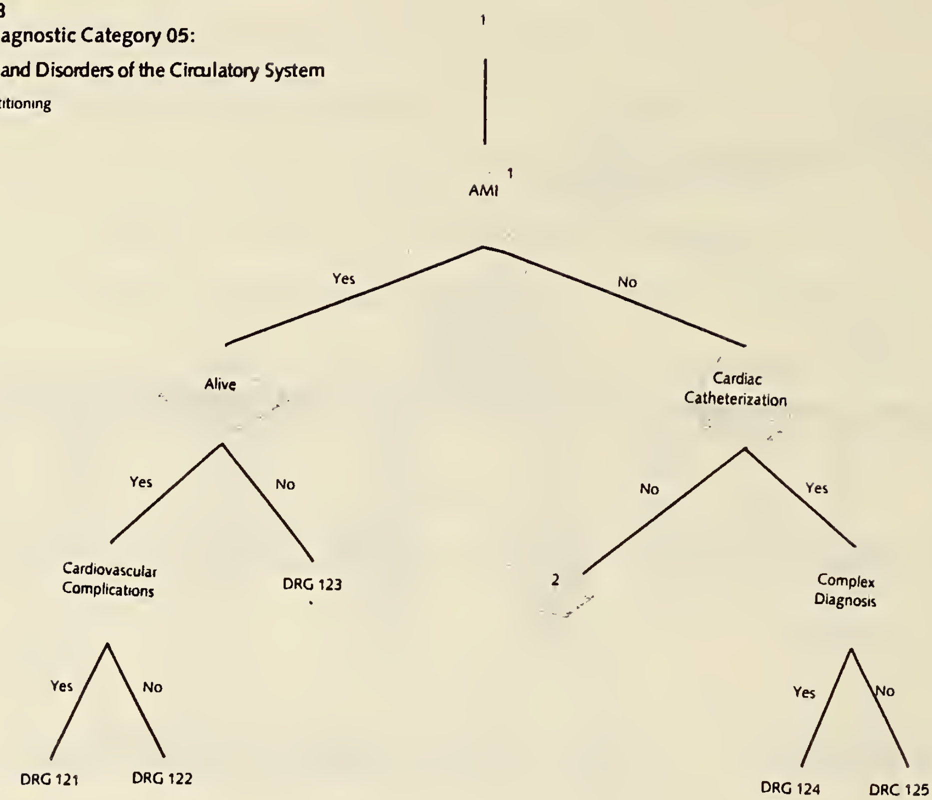
DECISION TREE FOR MAJOR DIAGNOSTIC CATEGORY 5: DISEASES AND DISORDERS OF THE CIRCULATORY SYSTEM



a DRG Support Group, Ltd., The Revised ICD-9-CM Diagnosis Related Groups, New Haven, Connecticut: Health Systems International.

FIGURE 6.2 CONTINUED

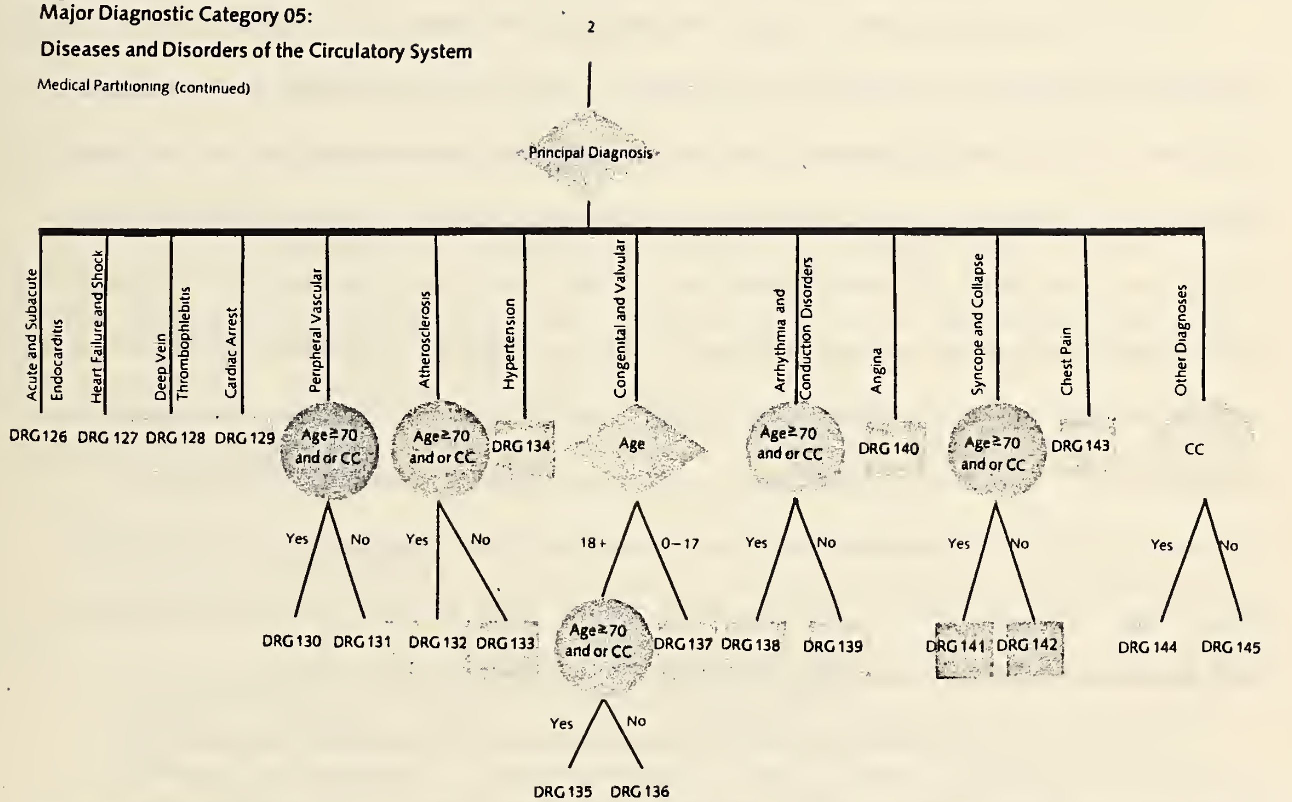
Figure 5B
Major Diagnostic Category 05:
Diseases and Disorders of the Circulatory System
Medical Partitioning



1. AMI = Acute Myocardial Infarction

FIGURE 6.2 CONTINUED

Figure 5C
Major Diagnostic Category 05:
Diseases and Disorders of the Circulatory System
Medical Partitioning (continued)



CC = Comorbidity and or Complication

the patient is alive or dead, and whether or not cardiovascular complications (from a specific list) arose. If an AMI did not occur, the next branching point specifies whether a cardiac catheterization was performed. If so, the cases are separated based upon existence of a complex diagnosis (again, from a specified list of complications).

Thus, from the start, certain "sicker" subclasses of patients are funneled into their own particular DRGs. This removes the more expensive patients, but it still leaves room for considerable variability at a lower level. For example, a patient may be admitted to the general medical floor for one or two days of observation as a "soft rule out myocardial infarction." Another patient, with a more typical history, may be admitted to the coronary intensive care unit for that monitoring, until the myocardial infarction is "ruled out." A third patient may have poorly controlled angina and be admitted for closely supervised manipulation of his medical regimen; this could take several days. All these patients have angina and coronary artery disease and could be assigned to DRGs 132 and 133.

Although the problems of varying severities of illness are not as pressing for these DRGs as for others, there may still be a spectrum of disease which accounts for a portion of the spread observed in DRGs 132 and and 133.

6.4 DISCRETIONARY USE OF RESOURCES

Because DRGs 132 and 133 are so poorly defined, it is difficult to speculate about the resource needs of a typical patient. For example, what are the resource implications for an asymptomatic patient with principal diagnosis code 41200, old myocardial infarction? Furthermore, due to the large number of possiblities precipitating cardiac enlargement (Code 42930), multiple different approaches could be taken. To limit the discussion, therefore, the following presentations will focus on patients with coronary artery atherosclerosis.

As noted in Figure 6.2 in the previous section, patients allocated to DRGs 132 and 133 by definition do not receive cardiac catheterization. This automatically removes the most costly (both from Part A and Part B perspectives) diagnostic option from consideration. The remaining technologies have relatively more expensive physician than hospital costs. A list of some of the technologic possibilities is as follows:

1. Electrocardiogram (ECG). The ECG is an easy, non-invasive test which can be performed by a technician in several minutes.[68]

2. Exercise Tolerance Test (ETT). Known also as the treadmill test, the ETT involves exercising the patient while closely monitoring for ischemic changes on the ECG.

3. Echocardiography. This non-invasive technique uses sound waves to visualize cardiac anatomy.

4. Cardiac Fluoroscopy. The purpose of this specialized x-ray is to detect calcification of the coronary arteries which may be related to atherosclerosis.

5. Radionuclide Studies: Nuclear Medicine Scans. Multiple radioactive tracers have been used to evaluate cardiac blood flow and function, including ^{99}Tc-labeled serum albumin, thallium-201, and ^{99m}Tc-pyrophosphate. Some of these tests involve injecting the label and scanning the patient at rest; others involve pacing or exercising the patient.

All of these tests except the ECG require the input of a specialist, a cardiologist or specialized radiologist. However, depending on institutional practice, even the ECG may have specialist costs attached. For example, certain hospitals maintain a strict policy that all ECGs be read by members of the cardiology department. Billings for ECG readings thus provide an important revenue source for the cardiology service.

68 Physicians often bill separately for reading the ECG (an exercise which typically takes a skilled reader less than a minute). Patients admitted for cardiac disease may receive multiple ECGs. ECG costs may contribute significantly to physician expenses and cost variability.

The other important discretionary resource from the Part B perspective is the consultation. Consultation use is probably also constrained by the definition of these DRGs. For example, a surgical consultation for possible coronary artery bypass graft is most appropriate in conjunction with catheterization. Most of these patients are probably adequately managed by a general medical physician, but consultation with a cardiologist is certainly an option.

In summary, since cardiac catheterization is separated from DRGs 132 and 133, the remaining discretionary resource options are relatively physician-costly. These high physician expenses may partially account for the disproportionate variation in Part B costs observed in these DRGs.

6.5 DIFFERENCES IN THERAPEUTIC APPROACH

Since the mid-1970s, the treatment of coronary artery disease (CAD) has been a field rife with controversy. Disputes have been waged on several topics: the use of coronary artery bypass graft surgery versus medical treatment of CAD; the costs and benefits of coronary intensive care unit (CCU) treatment of patients with suspected myocardial infarction (MI); and the appropriate length of stay for patients with a confirmed MI. By definition most of these disputes are outside the range of DRGs 132 and 133. However, it may be that the second area of controversy -- the value of CCU care -- is quite relevant to this group of patients.

As mentioned in the previous sections, the definitional imprecision in DRGs 132 and 133 yields a patient population with uncertain clinical attributes. However, the chart review conducted at University Hospital suggests that many of these patients are admitted with chest pain and placed on a "rule out MI" protocol; these patients are subsequently found not to have suffered a heart attack. Yet many of these patients probably spent several days at great expense, in the CCU.

> ...For as many as half of the patients admitted to CCUs with suspected infarction, the diagnosis is not subsequently confirmed... the CCU serves primarily as a safe place to stay while the information needed to exclude the diagnosis of myocardial infarction is gathered...three days in the CCU for evaluation including serial enzyme determinations is the accepted standard.[69]

In light of the high costs and unproven benefits of this practice, Mulley _et al._ at Massachusetts General Hospital challenged this three day standard. He developed an approach to identifying high risk patients who might benefit from the longer stay while targeting low risk patients who could be transferred out of the CCU after 24 hours.[70]

However, some would even challenge admission to the hospital in certain cases. Studies emanating from England in the 1970s suggested that even patients who have a confirmed MI may be adequately handled at home without increased risk of death. One of the most prominent such studies supported following patients at home who are elderly, who are seen some time after onset of the attack without having developed complications, and who desire home care.[71] This approach has its proponents in the United States, although the practice is by no means an accepted standard of care.

In summary, although it is difficult to deduce the clinical attributes of patients within DRGs 132 and 133, it is likely that they will be caught in at least some of the many controversies rampant in the area of CAD treatment. Biases towards more or less expensive care may be based on individual physician preferences, institutional variables (e.g., presence or absence of CCU, catheterization team), and idiosyncratic factors such as whether or not a CCU bed is available on a given day. Adequate cost/benefit studies have yet

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69 Albert G. Mulley _et al._, "The Course of Patients with Suspected Myocardial Infarction," _New England Journal of Medicine_ 302 (1980): 943.

70 Ibid., pp. 943-948.

71 H.G. Mather _et al._, "Myocardial Infarction: A Comparison Between Home and Hospital Care for Patients," _British Medical Journal_ (1976): 925-929.

to be performed in a number of these controversial areas; thus it is difficult to know at what level to target reimbursement norms.

6.6 STATE DATA

The clinical discussion suggests that the DRGs for atherosclerosis, angina, and chest pain may be treating clinically similar patients. If that is in fact the case and if clinical similarity leads to similar costs, then these DRGs should display approximately equal costs. The analyses below explore this question by generating a number of comparisons.

The first comparison is at the DRG level and is summarized in Tables 6.3 and 6.4. The findings are as follows:

1. The most surprising result is that in both states Part B costs are higher in the uncomplicated atherosclerosis DRG (DRG 133: Atherosclerosis Age < 70 w/o c.c.) than in the complicated one (DRG 132: Atherosclerosis Age > 69 and/or c.c.). The difference is most striking in New Jersey where DRG 133 costs were more than 50% greater than DRG 132 costs. This discrepancy persists even in light of contradictory length of stay data (see Figure 6.3). In both states, DRG 132 showed longer lengths of stay, by 1.11 days in New Jersey and 2.30 days in North Carolina.

   What can account for this unexpected finding that uncomplicated atherosclerosis has higher Part B costs than complicated atherosclerosis? The answer does not appear to lie in a higher percent of patients obtaining medical and surgical consultations (see Figure 6.4).[72] The clinical perspective also fails to yield a ready explanation. Perhaps physicians treating younger less complicated cases forsee a better prognosis and are thus more aggressive in their management approach. These patients may receive more ECGs, echocardiograms, and physician attention than patients with an anticipated poorer prognosis. It is interesting to note that patients in DRG 133 tend to have significantly more specialists as attending physicians than patients in DRG 132 (see Table 6.5). However, this factor alone probably accounts for the wide cost spread.

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72 The answer also does not lie in the possibility that those patients in DRG 133 who received consultations obtained more consultation visits. In New Jersey, of those patients receiving consultations, 1.2 medical and 1.2 surgical visits were made on average to patients in both DRGs 132 and 133. In North Carolina, DRG 132 and 133 also had identical average consultation visits: 1.2 medical and 1.1 surgical visits.

TABLE 6.3

DRG LEVEL COMPARISONS: PART B COSTS

NEW JERSEY

Comparison		Number of Cases	Mean Part B Costs	CV	T-test on Means[a]
DRG 132:	Atherosclerosis Age > 69 and/or c.c.	2,427	$616.65	1.3030	t=5.43
	COMPARED TO				p<.001
DRG 133:	Atherosclerosis Age < 70 w/o c.c.	697	$1,022.92	1.8830	259, 553
DRG 132:	Atherosclerosis Age > 69 and/or c.c.	2,427	$616.65	1.3030	t=8.70
	COMPARED TO				p<.001
DRG 140:	Angina Pectoris	9,488	$468.34	0.9970	115, 183
DRG 140:	Angina Pectoris	9,488	$468.34	0.9970	t=1.18
	COMPARED TO				N.S.
DRG 143:	Chest Pain	1,193	$451.85	0.6990	-10, 44

a Includes minimum and maximum values of 95% confidence interval around difference of mean values for DRGs.

TABLE 6.4

DRG LEVEL COMPARISONS: PART B COSTS

NORTH CAROLINA

Comparison		Number of Cases	Mean Part B Costs	CV	T-test on Means[a]
DRG 132:	Atherosclerosis Age > 69 and/or c.c.	6,053	$374.18	1.2770	t=4.87
	COMPARED TO				p<.001
DRG 133:	Atherosclerosis Age < 70 w/o c.c.	2,534	$442.86	1.4420	41, 97
DRG 132:	Atherosclerosis Age > 69 and/or c.c.	6,053	$374.18	1.2770	t=4.38
	COMPARED TO				p<.001
DRG 140:	Angina Pectoris	4,547	$330.74	1.5870	24, 62
DRG 140:	Angina Pectoris	4,547	$330.74	1.5870	t=2.38
	COMPARED TO				p<.01
DRG 143:	Chest Pain	1,744	$307.08	0.8420	5, 43

a Includes minimum and maximum values of 95% confidence interval around difference of mean values for DRGs.

Figure 6.3
Length of Stay: Mean Plus and Minus One Standard Deviation
ATHEROSCLEROSIS DRGs

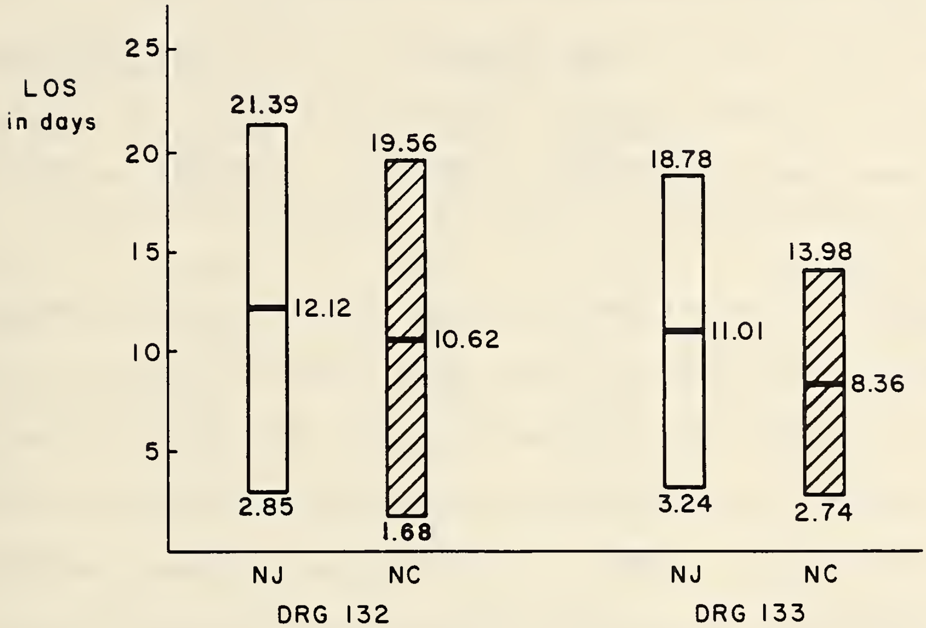


Figure 6.4
Percent of Patients Receiving
Medical and Surgical Consultations
ATHEROSCLEROSIS DRGs

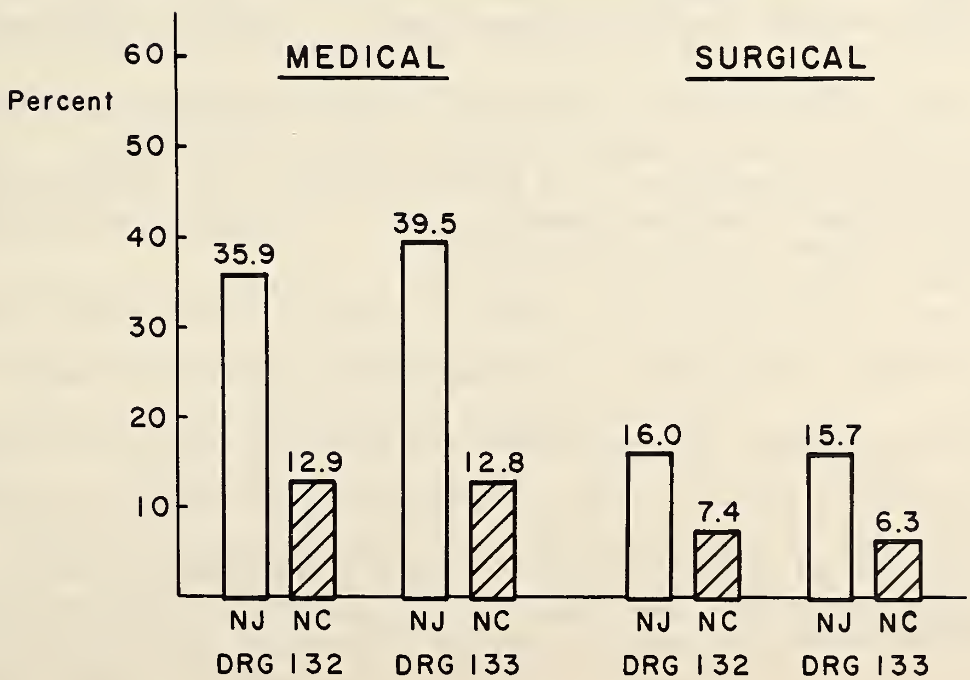


TABLE 6.5

SPECIALTY OF ATTENDING PHYSICIANS

(PERCENT OF CASES)

Specialty	NEW JERSEY[a] DRG 132 (N=2427)	NEW JERSEY[a] DRG 133 (N=697)	NORTH CAROLINA[b] DRG 132 (N=6053)	NORTH CAROLINA[b] DRG 133 (N=2534)
General/Family Practice	23.9	20.2	35.4	30.4
Internal Medicine	51.5	50.3	56.9	59.3
Cardiology	14.8	19.4	3.4	7.1
Other	9.8	10.1	4.3	3.2
	100.0	100.0	100.0	100.0

a Chi-square comparison of DRG 132 and 133 data yielded x^2=25.73, p<.001.

b Chi-square comparison of DRG 132 and 133 data yielded x^2=73.07, p<.001.

2. DRGs 132 and 140 have statistically significant different Part B costs. The differences appear obvious in New Jersey in which the mean DRG 132 cost is $148 higher than mean DRG 140 cost. However, the gap is not so apparent in North Carolina: DRG 132 mean cost is only $43 greater than DRG 140 mean cost. In this case, the variation is so high that there is probably considerable overlap of costs.

3. In both states, DRG 140 and 143 do not have substantially different mean costs. In New Jersey, the difference is in fact not statistically significant. In North Carolina, it is significant at the p<.01 level, but the numbers are very large. DRG 140 is only $24 more expensive on average than DRG 143.

Thus, these initial comparisons produce a surprising result when the two atherosclerosis DRGs are compared -- the complicated category is cheaper. The additional analyses suggest that the angina and chest pain DRGs have similar costs. The comparison between angina and atherosclerosis yields statistically significant differences in both states, but these differences are small, at least in North Carolina.

Given this background, the DRGs were broken down to individual ICD codes. The second comparison was made at this ICD code level.[73] Clinically similar ICD codes with large caseloads in different DRGs were compared. A number of the comparisons are listed in Tables 6.6 and 6.7. The differences tended to be greater in New Jersey than in North Carolina. Even so, in both states, some of the most important ICD codes in the different DRGs have very similar costs.

Another point illustrated by the ICD code analysis is the cost variability within individual codes (this is demonstrated in Figure 6.5). North Carolina (Table 6.7) offers the most obvious examples. For example, Code 41300 is the most specific angina pectoris code. Yet the CV for the 1,771 patients grouped into Code 41300 is 1.4636. A less detailed code (e.g., Code 41390: Other and unspecified angina pectoris) actually has a slightly lower but comparable CV (1.4577). Furthermore, ICD codes explain very little of the variability observed in the atherosclerosis DRGs (see Table 6.8). This belies the assumption stated in the first paragraph of this discussion (if one assumes that cases grouped at the ICD level are the most clinically similar groups and that "clinical similarity leads to similar costs"). The only tool available for assessing clinical similarity is the ICD code. But the data show that patients with the same ICD code have vastly different costs. Two explanations are possible: (1) that ICD codes do not successfully group clinically similar patients; and (2) that clinical similarity does not necessarily translate into similar costs. To some extent, from the clinical perspective, both explanations are probably correct.

Thus, the comparisons clarify some issues but raise others. As suggested by the clinical discussion, DRGs 132, 140, and 143 may be treating similar

73 Even at the ICD code level, DRG 133 codes were always more expensive than the identical DRG 132 codes. Therefore, these comparisons focus on the cheaper DRG 132 codes.

TABLE 6.6

ICD CODE LEVEL COMPARISONS: PART B COSTS

NEW JERSEY

Comparison	Number of Cases	Mean Part B Costs	CV	T-test on Means[a]
DRG 132, ICD Code 41490: Chronic ischemic heart disease, unspecified	617	$543.11	0.7835	t=1.98 p<.05
COMPARED TO				
DRG 140, ICD Code 41110: Intermediate coronary syndrome	2,951	$501.76	1.2936	0, 82
DRG 140, ICD Code 41390: Other and unspecified angina pectoris	2,742	$448.10	0.6910	t=0.12 N.S.
COMPARED TO				
DRG 143, ICD Code 78650: Chest pain, unspecified	1,161	$446.86	0.6794	-19, 21

a Includes minimum and maximum values of 95% confidence interval around difference of mean values for ICD codes.

TABLE 6.7

ICD CODE LEVEL COMPARISONS: PART B COSTS

NORTH CAROLINA

Comparison	Number of Cases	Mean Part B Costs	CV	T-test on Means[a]
DRG 132, ICD Code 42920: Cardiovascular disease, unspecified	881	$327.01	0.8649	t=0.033 N.S.
COMPARED TO				
DRG 140, ICD Code 41300: Angina decubitus	1,771	$327.50	1.4636	-29, 30
DRG 132, ICD Code 41490: Chronic ischemic heart disease, unspecified	520	$436.73	1.2356	t=0.80 N.S.
COMPARED TO				
DRG 140, ICD Code 41110: Intermediate coronary syndrome	647	$404.64	2.0424	-47, 111
DRG 132, ICD Code 42920: Cardiovascular disease, unspecified	881	$327.01	0.8649	t=0.78 N.S.
COMPARED TO				
DRG 140, ICD Code 41390: Other and unspecified angina pectoris	1,762	$315.72	1.4577	-17, 39
DRG 140, ICD Code 41390: Other and unspecified angina pectoris	1,762	$315.72	1.4577	t=0.65 N.S.
COMPARED TO				
DRG 143, ICD Code 78650: Chest pain, unspecified	1,702	$307.42	0.8482	-16, 32

a Includes minimum and maximum values of 95% confidence interval around difference of mean values for ICD codes.

Figure 6.5
North Carolina Part B Costs of Selected ICD Codes: DRG 132, 140, 143

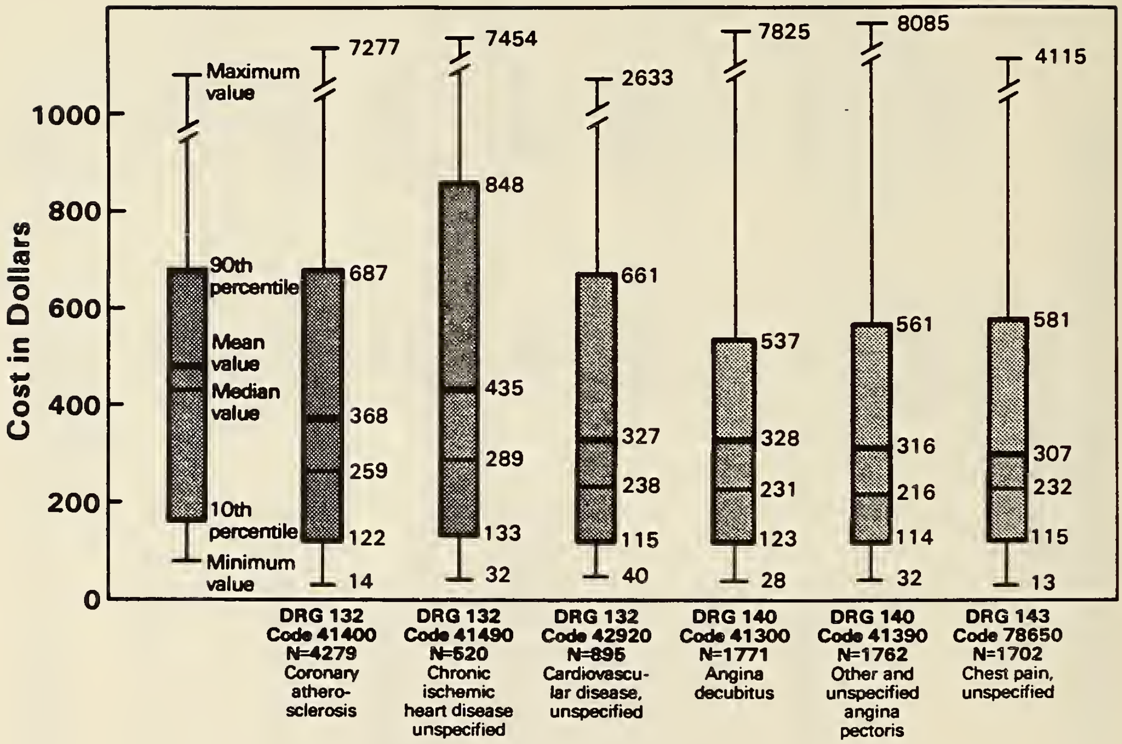


TABLE 6.8

R^2: REDUCTION IN VARIABILITY WHEN DRGS ARE SPLIT INTO ICD CODES

	PART A COSTS		PART B COSTS		LENGTH OF STAY	
DRG	New Jersey	North Carolina	New Jersey	North Carolina	New Jersey	North Carolina
132	0.004	0.007[a]	0.003	0.004[b]	0.015[a]	0.010[a]
133	0.005	0.012[a]	0.005	0.004	0.028[c]	0.008[b]

a Significant at $p<.001$.

b Significant at $p<.01$.

c Significant at $p<.05$.

patients who have similar costs. This is more apparent at the individual ICD code level. Because of the substantial cost overlap, these DRGs could perhaps be collapsed into one for reimbursement purposes. This would prevent the incentive for DRG creep which is strong in this setting. However, such a collapse would assume that the system would continue to tolerate high cost heterogeneity (as manifest by the high CVs already observed in these DRGs).

Two questions raised by these analyses are as follows:

1. Why is it so much more expensive on average for physician management of uncomplicated atherosclerosis than complicated atherosclerosis?

2. Why do costs remain so heterogeneous even at the level of individual ICD codes?

The clinical perspective may yield an answer to the second question, but the first remains elusive. The differences are so striking that this may be an interesting area for further study.

6.7 IMPLICATIONS OF PROSPECTIVE REIMBURSEMENT FOR PHYSICIAN BEHAVIOR

The major implications of the use of these DRGs in a PPS to reimburse physicians can be grouped into three areas.

The first area involves "DRG creep." The implicated DRGs and their relative weights are as follows:

DRG 132	Atherosclerosis Age > 69 and/or c.c.	RW 0.9182
DRG 133	Atherosclerosis Age < 70 w/o c.c.	RW 0.8599
DRG 140	Angina Pectoris	RW 0.7548
DRG 143	Chest Pain	RW 0.6814

Given these weightings, there is virtually no incentive to ever assign a patient to DRGs 140 and 143. Since from the clinical perspective these are not mutually exclusive categories, reassignment of all these patients makes perfect medical sense. For example, most patients with the clinical diagnosis of angina pectoris have an underlying pathologic diagnosis of coronary atherosclerosis. Listing a diagnosis of coronary atherosclerosis would thus be both technically correct and financially profitable. If the relative weights were to shift under a physician PPS to favor angina, for example, the coding practice could just as legitimately follow. All patients with clinically symptomatic coronary athersoclerosis have angina! Thus, DRG creep seems almost inevitable given the definitional inconsistencies in these DRGs.

Second, the use of many of the physician-costly discretionary resources can be easily shifted to an outpatient setting. Exercise tolerance tests and echocardiograms are particularly likely to take place after the acute hospitalization. A corollary of this practice may be increased splitting of admissions. For example, a patient comes into the hospital with increasing anginal pain. He is ruled out for a MI and placed upon a medical regimen which controls his pain. He is considered a good surgical candidate, but requires further work-up. He is discharged for ETT then readmitted electively for catheterization. However, since surgery was seriously contemplated and since catheterization is a prerequisite to final surgical decision (the ETT is helpful but catheterization is the "gold standard"), why not perform that procedure during the first admission?[74]

Finally, there may be an incentive to admit patients for single or multiple short stays, with only minimal indication. If one is paid just as much for admitting a patient overnight ("to watch that the chest pain is well-controlled," for example) or as a quick "rule out MI," why not?

6.8 SUMMARY AND CONCLUSIONS

The atherosclerosis DRGs suffer from a widespread problem in the area of cardiovascular disease syntax -- confusing terminology. DRGs 132 and 133 form a set with the angina and chest pain categories (DRGs 140 and 143) which all

74 The issue of splitting admissions may not be this clearcut. Many hospitals which perform both cardiac catheterizations and coronary artery surgery have waiting lists from days to weeks for these procedures. To remain in the queue, a patient must stay in the hospital. Splitting admissions may actually be good in this setting. Patients (who were medically stable) would remain at home during the wait rather than passing inappropriate days in the hospital.

describe identical patients. These DRGs and the ICD codes upon which they are based are defined by different types of criteria -- symptoms, clinical diagnoses, and pathologic processes. A single patient with angina generally fits all three criteria. Thus, these DRGs fail to delineate clinically mutually exclusive groups of patients. Manipulation of the group into which a patient falls would make perfect medical sense.

The data used in this study antedate the nationwide hospital DRG system and reflect coding practices as they existed in 1982. Coding styles in New Jersey and North Carolina appear to be very different. A larger proportion of North Carolina patients receive a pathologic diagnosis of atherosclerosis while a larger fraction of New Jersey patients receive a clinical diagnosis of angina pectoris. A number of inconsistent decision rules appear to guide the diagnostic coding of these patients. It is not always clear when the angina diagnosis supercedes the atherosclerosis diagnosis, but the myocardial infarction diagnosis always seems to appear on top (even if the heart attack was caused by coronary atherosclerosis, which it generally is). This ICD code determination is dictated by individual physician practices and medical record room procedures. The quality of this information is thus highly variable.

Given these definitional problems, it is not unexpected that DRGs 132 and 133 have high CVs. What is particularly interesting is that the Part B CV is greater than the Part A CV. This may be in part the result of the way patients are allocated to these DRGs. If a patient receives a cardiac catheterization they are automatically removed to another branch of the DRG decision tree. The remaining technologic options are relatively more physician- than hospital-costly.

The state data analysis focused upon comparison of Part B costs, across DRGs 132, 133, 140, and 143 and between particular ICD codes. The most surprising result of the DRG level comparison was that costs were greater for younger, uncomplicated atherosclerosis patients (DRG 133) than for older, complicated atherosclerosis patients. The reason for this is elusive but may lie in a generally more aggressive therapeutic approach to younger, healthier patients. In both states, DRGs 140 and 143 have similar average Part B costs.

Even once cases are disaggregated into ICD codes large cost variability remained. The ICD codes also explain very little of the variance within DRG 132 and 133 costs. When codes are compared across DRGs, they often have similar costs. This is particularly true in North Carolina where some of the largest codes in DRGs 132, 140, and 143 have similar costs.

If different weightings apply to DRGs 132, 133, 140, and 143 under a physician PPS the incentive would be to always assign a case to the most lucrative DRG. As explained above, in most instances this would make perfect clinical sense, but it may still qualify as DRG creep. In the worse possible case of creep, the following scenario may apply. As described in the University Hospital chart review summary, most patients with ICD codes fitting DRGs 132 and 133 were admitted for "rule out MI." They were later diagnosed as having coronary atherosclerosis. But as outlined in Footnote 2, ICD coding procedures stipulate that diagnoses listed as "rule out" be coded as if the condition actually existed. If physicians opted to continue describing patients as "rule out MI," they would be assigned to myocardial infarction DRG 122 with a relative weight of 1.3651.[75] Thus, the incentives involved in

75 An unpublished study at Yale-New Haven Hospital, the Mayo Clinic, San Francisco General, and several other hospitals found that 10 to 15% of cases coded as myocardial infarction at discharge were listed as "rule out MIs" by their physicians but actually had not had an MI. They had "ruled out" during their hospitalization, but because of coding rules were listed as having had a myocardial infarction. These cases were systematically discharged after brief stays. Personal communication, Dr. Bob Mullin, New Haven, Connecticut.

the atherosclerosis DRGs are similar for physicians and hospitals, as follows:

1. DRG Creep. These DRGs offer the perfect opportunity for DRG creep; in fact, such creep is clinically completely correct. Both physicians and hospitals have an incentive to assign patients to the most lucrative DRG.

2. "Rule Out MI." Hospitals have an incentive to admit patients with chest pain for brief "rule out MI" stays. Physicians have the same incentive. Both have the incentive to list as the discharge diagnosis, "rule out MI."

3. Outpatient Testing. Hospitals have an incentive to shift as many tests as possible to an outpatient setting. Physicians have the same incentive.

4. Splitting Admissions. Hospitals have an incentive to split diagnostic and surgical admissions. Physicians have the same incentive. In cases where a long queue exists for expensive tests and procedures, this may actually be helpful.

Given the high prevalence of coronary artery disease in the American population, these are extremely important DRGs. However, they are fraught with problems. One possible solution is to consider lumping clinically identical DRGs. Another is to change coding procedures relating to "rule out" conditions. Both these options warrant further study.

Chapter 7

GASTROINTESTINAL HEMORRHAGE: MEDICAL DRGS

DRG 174: GI Hemorrhage Age > 69 and/or c.c.

DRG 175: GI Hemorrhage Age < 70 without c.c.

7.1 INTRODUCTION

The long, hollow tube which constitutes the gastrointestinal tract is uniquely susceptible to irritations and insults which precipitate bleeding. In addition, the blood loss is often very obvious to the patient. Bright red blood arising during vomiting or passing from the rectum is an intensely frightening occurrence. Gastrointestinal hemorrhage thus prompts hundreds of thousands of admissions annually to acute care hospitals. Certain causes of hemorrhage are common across the adult population (peptic ulcers and gastritis, for example). However, other specific conditions predispose the elderly to such bleeding: diverticulosis, angiodysplasia, bowel malignancy. The relatively high caseloads on the New Jersey and North Carolina Medicare rolls reflect this high incidence: DRGs 174 and 175 account for 3,922 cases in New Jersey and 3,505 cases in North Carolina. Even these figures belie the true frequency of gastrointestinal hemorrhage, since a large proportion of patients are treated surgically.

Medical treatment of these patients is extremely costly. Part A costs for the two DRGs totalled $10,024,057 in New Jersey and $6,765,777 in North Carolina; Part B costs equalled $2,868,674 in New Jersey and $1,503,690 in North Carolina. Given these large expenditures, cost variation within the DRGs is worrisome. For the more populated DRG 174, New Jersey Part A costs show a CV of 0.9430, and Part B costs have a CV of 0.8210. North Carolina CVs are worse. The Part A CV is 1.2650, and the Part B CV is 1.0020. Can the clinical perspective elucidate the source of a portion of this variance? The answer arises on three levels as follows:

1. The gastrointestinal hemorrhage DRGs contain a variety of clinical entities, defined more as symptoms than diagnoses;

2. Each unique clinical entity can present with widely varying degrees of severity and risk for rebleeding; and

3. For each degree of severity within each clinical entity, the diagnostic and therapeutic approach may be quite different for different patients.

The following discussion expands on these several tiers of clinical concerns, focusing on the issue of multiple discretionary resources.

7.2 DEFINITIONAL PRECISION

The title of DRGs 174 and 175, "GI Hemorrhage," is sufficiently broad to incorporate a vast spectrum of diseases. The gastrointestinal tract technically extends from the mouth to the anus. Different portions of this tract are susceptible to different pathogenic mechanisms, and may thus bleed for very different reasons requiring very different therapies. For example, esophageal varices (dilated esophageal veins most common in patients with end-stage liver disease such as chronic alcoholics) are very different from colonic diverticuli (small outpouchings of the colon present to some degree in virtually 50% of persons over age 65). They can both precipitate massive bleeding, but they demand very different diagnostic and therapeutic approaches.

However, upon study of the ICD codes which define these DRGs, it becomes clear that these DRGs are not as broad as their title implies. All causes of gastrointestinal hemorrhage are not assigned to these DRGs. In fact, perhaps several of the most common specific causes of gastrointestinal hemorrhage in the elderly -- bowel malignancy, diverticular disease, and gastritis -- are assigned to other DRGs (DRGs 172, 173 and DRGs 182, 183, 184). Out of the 38

ICD codes which create DRGs 174 and 175, thirty-two pertain to ulcer disease (see Table 7.1).[76] The definitional imprecision in the DRGs probably stems from the last four codes in the list: Code 56930, Rectal and Anal Hemorrhage; Code 57800, Hematemesis; Code 57810, Melena; and Code 57890, GI Hemorrhage NOS. These codes are well represented in the New Jersey and North Carolina data. The data raise the following concerns (see Figure 7.1):

1. Code 57890, GI Hemorrhage NOS is the most common code in New Jersey (56.8% of patients in DRG 174; 53.7% of patients in DRG 175). It is the second most common code in North Carolina (27.7% of patients in DRG 174; 21.2% of patients in DRG 175). However, this code represents a symptom, not a diagnosis. Because of its poor definition, Code 57890 could presumably run the gamut of disorders -- from diverticular disease to bleeding malignancies to bleeding of unknown origin. It is difficult to assess why this code is so common: is the problem one of poor data quality in medical records coding, or is the problem one of failure of the medical work-up to reveal a specific diagnosis? Regardless, this ICD code is not at all helpful in defining the clinical condition of the patient, and thus yields little information which assists in predicting resource use.

2. The most common code in North Carolina is Code 57800, Hematemesis (vomiting of blood, 29.7% of patients in DRG 174 and 26.7% of patients in DRG 175). This code does not appear on the top five list for New Jersey, suggesting different styles in coding patients between the two states. Hematemesis, similarly, is a symptom and not a diagnosis. As a symptom it is somewhat helpful in the sense of localizing the lesion to the upper gastrointestinal tract. But beyond that, it connotes little about the actual disease process. A patient with hematemesis could be suffering from esophageal varices, malignancy, gastritis, peptic ulcer disease, or another of many other clinical entities. Each of these would require a different approach and pattern of resource consumption.

3. A related problem is that of Code 57810, Melena (literally "black stool"). In terms of caseload, it does not appear to be a common principal diagnosis (2.7% of patients in DRG 175 in both states). But it also is a symptom, not a diagnosis. As a symptom, it is useful only in indicating the presence of blood loss. Although suggestive of an upper tract bleeding source, it does not definitively localize or identify the disease process (for example, gastritis and colonic angiodysplasia may both present as melena).

76 Ulcer disease appears in five different DRGs. DRGs 174 and 175 incorporate bleeding ulcers. DRG 176, "Complicated Peptic Ulcer," includes perforated ulcers and those which cause obstruction. Both DRGs 177 and 178, "Uncomplicated Peptic Ulcer," contain eight ICD codes pertaining to ulcers; each of the eight codes is a "NOS" (not otherwise specified) code. By default these two DRGs are thus not clearly defined.

TABLE 7.1

ICD-9-CM CODES CONTAINED IN DRGS 174 AND 175

DRG 174, MDC 06M, GI HEMORRHAGE AGE ≥ 70 AND/OR CC

PRINCIPAL DIAGNOSIS

45600	Esophag Varices W Bleed	53301	Ac Peptic Ulc W Hem-Obst
53070	Mallory-Weiss Syndrome	53320	Ac Peptic Ulc W Hem/Perf
		53321	Ac Pept Ulc Hem/Perf-Obs
53100	Ac Stomach Ulcer W Hem	53340	Chr Peptic Ulcer W Hem
53101	Ac Stomac Ulc W Hem-Obst	53341	Chr Peptic Ulc W Hem-Obs
53120	Ac Stomac Ulc W Hem/Perf	53360	Chr Pept Ulc W Hem/Perf
53121	Ac Stom Ulc Hem/Perf-Obs	53361	Chr Pept Ulc Hem/Perf-Ob
53140	Chr Stomach Ulc W Hem	53400	Ac Marginal Ulcer W Hem
53141	Chr Stom Ulc W Hem-Obstr	53401	Ac Margin Ulc W Hem-Obst
53160	Chr Stomach Ulc Hem/Perf	53420	Ac Margin Ulc W Hem/Perf
53161	Chr Stom Ulc Hem/Perf-Ob	53421	Ac Marg Ulc Hem/Perf-Obs
53200	Ac Duodenal Ulcer W Hem	53440	Chr Marginal Ulcer W Hem
53201	Ac Duoden Ulc W Hem-Obst	53441	Chr Margin Ulc W Hem-Obs
53220	Ac Duoden Ulc W Hem/Perf	53460	Chr Margin Ulc Hem/Perf
53221	Ac Duod Ulc Hem/Perf-Obs	53461	Chr Marg Ulc Hem/Perf-Ob
53240	Chr Duoden Ulcer W Hem		
53241	Chr Duoden Ulc Hem-Obstr	56930	Rectal Anal Hemorrhage
53260	Chr Duoden Ulc Hem/Perf	57800	Hematemesis
53261	Chr Duod Ulc Hem/Perf-Ob	57810	Melena
53300	Ac Peptic Ulcer W Hemorr	57890	Gastrointest Hemorr NOS

DRG 175, MDC 06M, GI HEMORRHAGE AGE < 70 W/O CC

PRINCIPAL DIAGNOSIS

45600	Esophag Varices W Bleed	53301	Ac Peptic Ulc W Hem-Obst
53070	Mallory-Weiss Syndrome	53320	Ac Peptic Ulc W Hem/Perf
		53321	Ac Pept Ulc Hem/Perf-Obs
53100	Ac Stomach Ulcer W Hem	53340	Chr Peptic Ulcer W Hem
53101	Ac Stomac Ulc W Hem-Obst	53341	Chr Peptic Ulc W Hem-Obs
53120	Ac Stomac Ulc W Hem/Perf	53360	Chr Pept Ulc W Hem/Perf
53121	Ac Stom Ulc Hem/Perf-Obs	53361	Chr Pept Ulc Hem/Perf-Ob
53140	Chr Stomach Ulc W Hem	53400	Ac Marginal Ulcer W Hem
53141	Chr Stom Ulc W Hem-Obstr	53401	Ac Margin Ulc W Hem-Obst
53160	Chr Stomach Ulc Hem/Perf	53420	Ac Margin Ulc W Hem/Perf
53161	Chr Stom Ulc Hem/Perf-Ob	53421	Ac Marg Ulc Hem/Perf-Obs
53200	Ac Duodenal Ulcer W Hem	53440	Chr Marginal Ulcer W Hem
53201	Ac Duoden Ulc W Hem-Obst	53441	Chr Margin Ulc W Hem-Obs
53220	Ac Duoden Ulc W Hem/Perf	53460	Chr Margin Ulc Hem/Perf
53221	Ac Duod Ulc Hem/Perf-Obs	53461	Chr Marg Ulc Hem/Perf-Ob
53240	Chr Duoden Ulcer W Hem		
53241	Chr Duoden Ulc Hem-Obstr	56930	Rectal Anal Hemorrhage
53260	Chr Duoden Ulc Hem/Perf	57800	Hematemesis
53261	Chr Duod Ulc Hem/Perf-Ob	57810	Melena
53300	Ac Peptic Ulcer W Hemorr	57890	Gastrointest Hemorr NOS

Figure 7.1A
Five Most Common ICD Diagnoses
in DRG 174

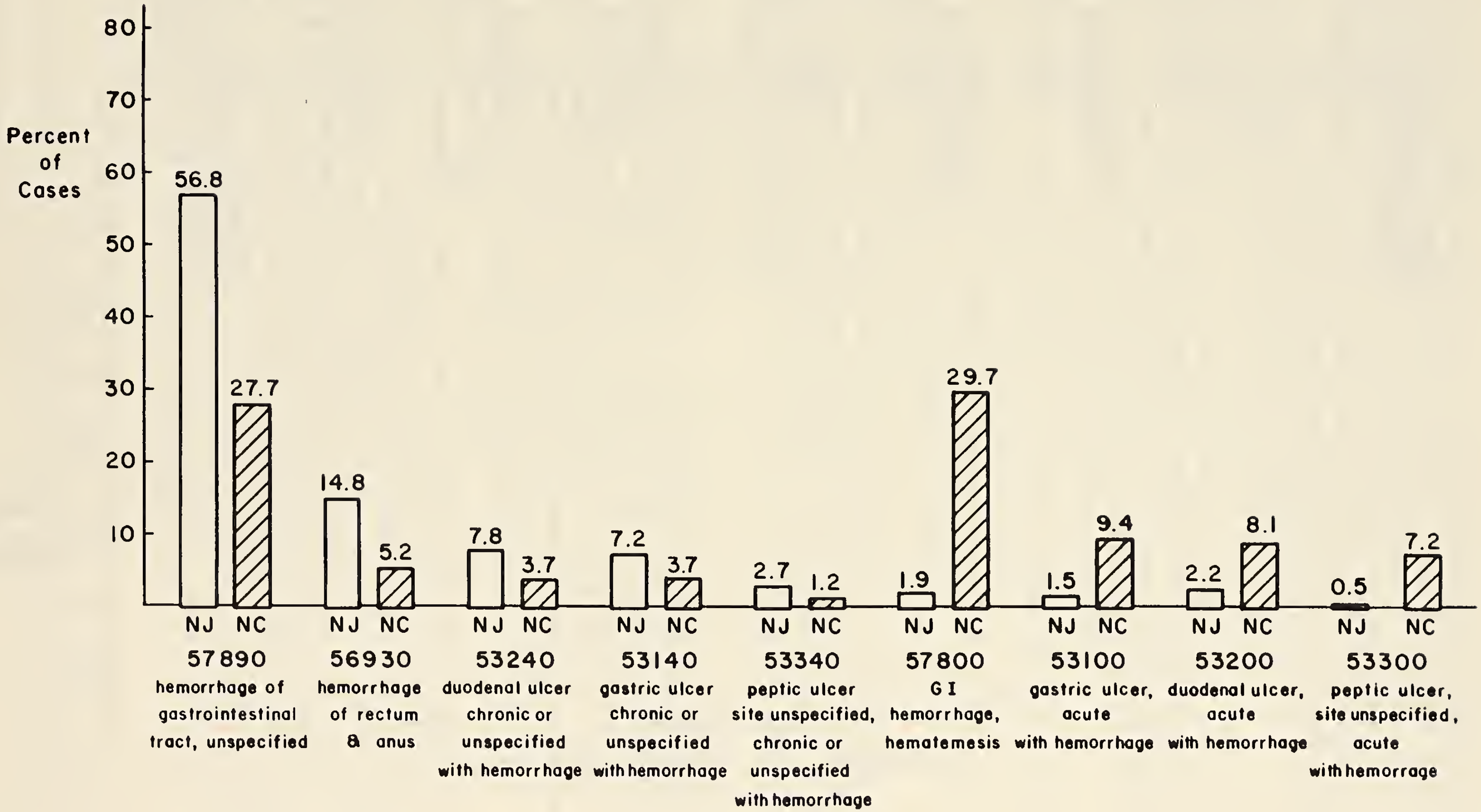
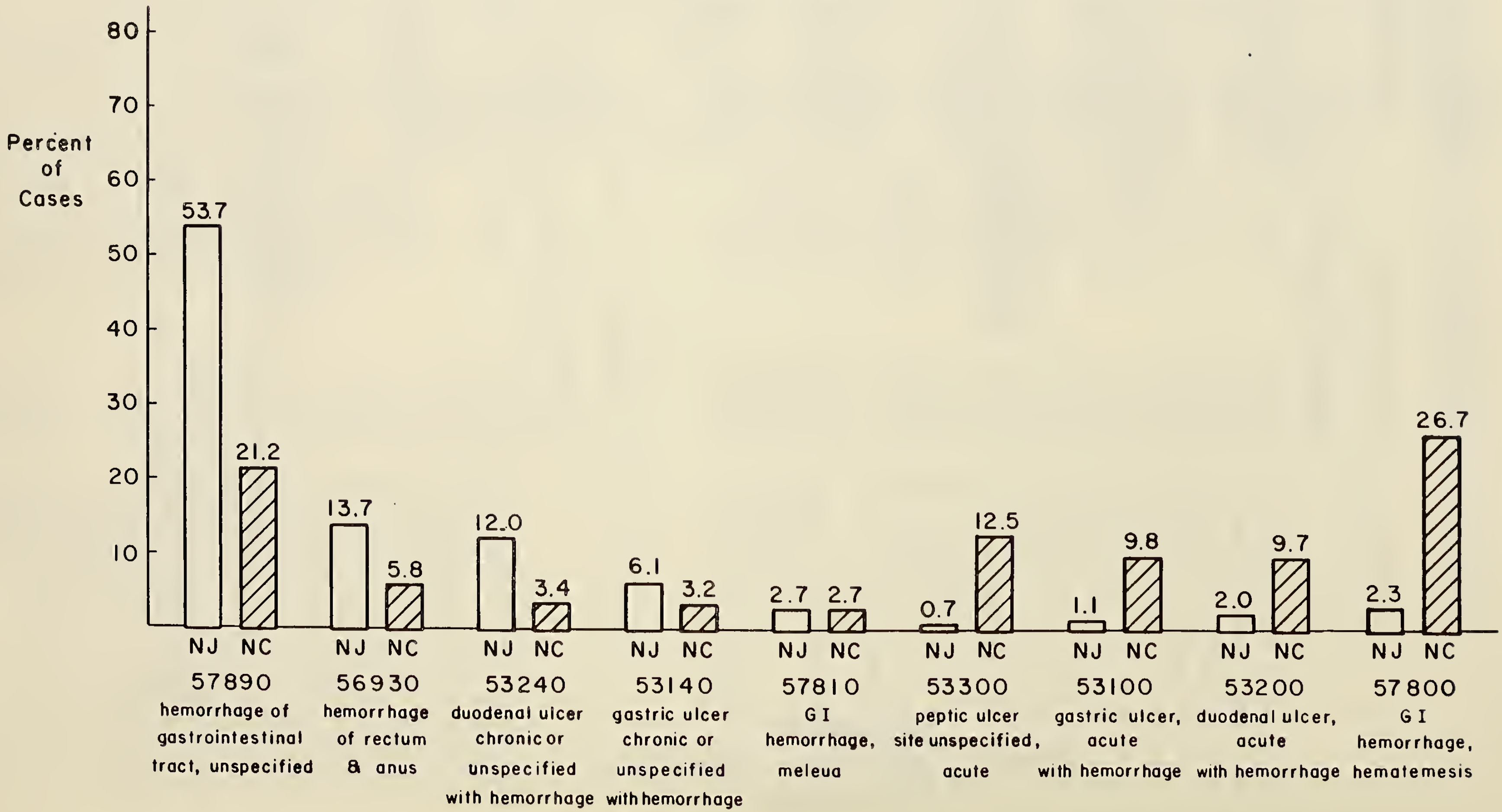


Figure 7.1B
Five Most Common ICD Diagnoses
in DRG 175



4. Although Code 56930, Hemorrhage of Rectum and Anus, appears more helpful because it specifies the area involved, this code also represents a symptom and not a diagnosis. This is the second most common code in New Jersey (14.8% of patients in DRG 174 and 13.7% of patients in DRG 175); it is much less common in North Carolina list. Many of these patients may have hemorrhoids, but it is especially important to rule out malignancy in elderly patients. Once again the ICD code does not reflect the actual disease process.

5. As mentioned earlier, 32 of the 38 codes in these DRGs incorporate the diagnosis peptic ulcer disease. However, the majority of patients in both states do not fall into these diagnostic codes. The top ulcer codes are only ranked third in the lists of the top five most frequent ICD codes in both states and both DRGs.

In summary, after reviewing the data from New Jersey and North Carolina, the definitional precision issue appears to raise important concerns for the gastrointestinal hemorrhage DRGs. The problem is several-fold:

1. The most common ICD codes are very non-specific; they are symptoms and not diagnoses. They could represent almost any disease process precipitating gastrointestinal bleeding, from peptic ulcer disease to malignancy to diverticulosis to tears of the esophagus (Mallory-Weiss syndrome) to hemorrhoids.

2. The two states appear to either code somewhat differently or to be treating different patients. For example, the Code 57890, GI Hemorrhage NOS, occurs in over half of New Jersey's patients, but only about one quarter of North Carolina's patients. Hematemesis is the most common code for North Carolina in both DRGs; it does not appear on New Jersey's top five list. Hemorrhage of the rectum and anus is the second most common diagnosis in New Jersey, but it does not appear on North Carolina's top five list.

3. Several of the most common causes of gastrointestinal hemorrhage in the elderly (i.e., malignancy, diverticular disease, and gastritis) have specific codes which appear under other DRGs. These codes, however, do not specify if bleeding occurred. It is very likely that many of the patients in Codes 57890, GI Hemorrhage NOS, 57800 Hematemesis and 56930 Rectal/Anal Hemorrhage actually have one of these three diseases, with only the symptom of the disease (bleeding) being coded. The following clinical discussion will assume that patients with these problems who bleed often are given the principal "diagnosis," gastrointestinal hemorrhage, and thus reach DRGs 174 and 175.

Given that the ICD codes themselves are so imprecise, it is impossible for the DRGs to be neatly defined. Thus, definitional imprecision is an important problem for DRGs 174 and 175.

7.3 SEVERITY OF ILLNESS[77]

Given the broad definitions allowed by DRGs 174 and 175, gastrointestinal hemorrhage could span the spectrum of severity. These DRGs include both patients who are acutely briskly bleeding as well as those with chronic, slow blood loss. At one end of the spectrum is the patient whose disease has eroded into a major abdominal vessel. This patient could exsanguinate in minutes to hours; he requires immediate, heroic, life-saving measures. At the other end of the spectrum is the patient with a slow, oozing bleed from a benign colonic polyp and a small drop in blood count. This patient must be closely watched, but there is time to carefully evaluate and plan therapy.

One of the major clinical dilemmas surrounding the gastrointestinal bleeder is unpredictability. Even if a patient appears stabilized, he must still be considered at risk for rebleeding. An average of 25% of patients with upper gastrointestinal bleeding will rebleed during their hospitalization.[78] This percentage is higher for certain diseases. For example, 70% of patients with esophageal variceal bleeding will rebleed in the first 48 hours. Lower gastrointestinal bleeding is also likely to recur. For example, most bleeding from diverticulosis ceases spontaneously a few hours after it starts. But 25% of patients continue to bleed, and 25% of those who had stopped will rebleed during their hospital stay. Because of this risk of rebleeding, gastrointestinal bleeders must be carefully monitored, often in the intensive care unit setting, until several days have safely passed from the acute event. Patients with repeated episodes of bleeding are more costly to treat.

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77 Mark C. Fishman *et al.*, *Medicine*, Philadelphia: J.B. Lippincott Company, 1981: 245-252.

78 The DRGs do not provide a separate grouping for this significant proportion of patients who rebleed.

Another problem with patients with gastrointestinal hemorrhage is the presence of significant comorbidities. For example, about half of the patients with upper gastrointestinal hemorrhage have major heart, kidney, or liver disease.[79] Failure of these organs can be exacerbated by the gastrointestinal bleeding: acute upper gastrointestinal hemorrhage has an overall mortality of 10%, and these are the patients most likely to die. Elderly patients with diverticular disease or malignancy are less able to withstand the stresses of a major gastrointestinal bleed. The heart is particularly compromised by loss of significant volumes of blood.

Therefore, gastrointestinal bleeding is an important symptom which physicians take very seriously. However, the course of bleeding may range considerably on the severity scale. At the most severe level is the patient who will die without a major, usually costly intervention. At the least severe level is the patient with minimally bleeding hemorrhoids. Inbetween lies that worrisome group of patients who are at risk for rebleeding and must therefore be carefully watched. Paralleling this severity of illness spectrum is cost. Obviously, the patient who presents with an acute upper gastrointestinal bleed from esophageal varices with risk for another will be more expensive to treat than the patient with a slow oozing bleed from a benign polyp.

7.4 DISCRETIONARY USE OF RESOURCES

In order to adequately treat a patient with gastrointestinal hemorrhage, the physician must know the answer to two questions. First, where is the blood coming from? Second, what is the disease process causing the bleeding? In broaching this question of site, physicians have traditionally separated the gastrointestinal tract into two portions: upper and lower, defined as

79 Ibid., p. 248.

above and below the ligament of Treitz (an anatomic landmark early in the small intestine). The risk of massive, life-threatening hemorrhage is generally greatest in an upper gastrointestinal bleed, although patients with lower gastrointestinal processes such as diverticular disease can also massively bleed. Initial assessment therefore focuses on identifying the location of bleeding.

Unfortunately, history and physical exam are not as helpful in defining the source and nature of disease as in other processes (e.g., cerebrovascular disease). For example, if a patient gives a history of peptic ulcer disease or bowel cancer, this is suggestive but does not confirm these disorders as the cause of bleeding. In patients with a confirmed history of esophageal varices, half of the bleeding episodes are caused by another process (e.g., alcoholic gastritis). A history of frank vomiting of blood is very helpful in localizing the bleeding site to the upper gastrointestinal tract, but a history of hematochezia (bright red blood per rectum) or melena is of little help in localization.

Even the physical exam may be of little assistance in identifying the site and cause of bleeding. The physical exam may suggest the amount of blood a patient has lost. For example, if a patient has a low blood pressure and a rapid heart rate while lying down, he probably has lost a significant portion of his blood volume. But it does not reveal where or why the blood was lost. Putting a nasogastric tube into the patient's stomach is a standard first assessment approach. If the stomach contents show signs of blood, the upper gastrointestinal tract is implicated. However, a negative study of stomach contents does not rule out an upper gastrointestinal bleed. The patient could be bleeding anywhere in his gastrointestinal tract.

Because of this diagnostic dilemma, there has been a burgeoning of diagnostic technologies, specialists, and subspecialists to aid in the diagnosis of a gastrointestinal bleed. Many patients with evidence of a gastrointestinal bleed will now eventually come in contact with at least one specialist during his work-up. "Nowhere in medicine is cooperation between the various disciplines more vital, requiring the involvement of the internist, surgeon, and radiologist from the outset."[80] This is true for patients spanning the severity continuum, as shown in the following two scenarios:

1. A patient is brought into the emergency room with evidence of a massive gastrointestinal hemorrhage. Not only are emergency specialists required to stabilize the patient, but also gastroenterologists (especially those subspecializing in endoscopy), surgeons, angiographers (radiologists), and the intensive care unit team may be required to evaluate the patient; and

2. During a routine physical, a patient is found to have blood in his stool. His general medical doctor obtains a barium enema which identifies a "suspicious" lesion. The patient is then referred to a gastroenterologist for colonoscopy to further define this lesion. If malignancy is confirmed, an entire array of specialists from surgeons to oncologists may be consulted.

Thus, a wide variety of physician consultants may be asked to evaluate the gastrointestinal bleeder. Some of these consultants may be subspecialists, such as gastroenterologist-endoscopers specializing in sclerotherapy of esophageal varices or angiographers (specialized procedural radiologists) experienced in selective vasopressin infusions for bleeding ulcers. Because of this diverse assortment of potential consultants, physician costs can vary widely for different patients.

Paralleling this spectrum of specialists are their various technologies. Conventional non-invasive tests have proven of relatively little use in the

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80 Michael L. Steer and William Silen, "Diagnostic Procedures in Gastrointestinal Hemorrhage," New England Journal of Medicine 309 (1983): 646.

work-up of gastrointestinal bleeders. For example, the flat plate x-ray of the abdomen (KUB) is only helpful if bowel ischemia is the hypothesized cause of bleeding and if the characteristic "thumbprinting" pattern appears on the x-ray. Therefore, more invasive, costly, and risky tests are required, as follows[81]:

1. Endoscopy. Recent advances in fiberoptic technology have translated into a major diagnostic and therapeutic tool -- endoscopy. Using an endoscope, one can actually see the lining of the gastrointestinal tract. The optimal diagnostic result is direct visualization of a bleeding lesion. The endoscope has been continually refined, so that now lasar coagulation and sclerotherapy can be performed through this narrow tube. Minor surgery can also be achieved using endoscopy, such as removing a polyp or taking a biopsy. Thus, it is both a powerful diagnostic and therapeutic instrument. As a diagnostic tool it far surpasses older technologies: the diagnostic accuracy of an upper gastrointestinal study by an experienced endoscoper is 75 to 90%, whereas for the conventional barium swallow radiographic study, accuracy is only 20 to 50%.

   Despite the obvious appeal of providing a direct view of a bleeding lesion, the use of endoscopy in the acute, emergent setting for diagnosis is controversial. The genesis of the controversy is severalfold: (1) endoscopy is costly plus it carries acknowledged risks -- even in expert hands, 0.5% of patients undergoing upper tract endoscopy experience a major complication (e.g., perforation, bleeding, aspiration leading to pneumonia); (2) 85 to 90% of bleeders spontaneously stop hemorrhaging within a few hours; and (3) early diagnosis through prompt endoscopic investigation has not been proven to enhance patient outcome.

   This last point is perhaps the most thorny. The area of gastrointestinal hemorrhage is one in which many agree that the power of diagnositc tools has far surpassed available therapeutic options. Several clinical studies have tried to objectively evaluate the benefit of early endoscopic diagnosis. A well-respected, randomized, controlled trial of upper gastrointestinal bleeders from Texas showed "no benefit in routine early endoscopy... making a diagnosis did not influence outcome. Although this observation is contrary to classical medical teaching, it is not surprising since therapy was not affected. If better, more specific therapeutic measures were available, making a diagnosis might be of greater value."[82] However,

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81 Ibid., p. 646-650.

82 Walter L. Peterson et al., "Routine Early Endoscopy in Upper Gastrointestinal Tract Bleeding," New England Journal of Medicine 304 (1981): 928.

the researchers acknowledge that later endoscopy, following the acute event, may yield important diagnostic information which would dictate therapy.

Therefore, several authors have attempted to set guidelines for proper use of diagnostic endoscopy for both upper and lower tract disease. Because of its lower complication rate, lower tract endoscopy (anoscopy, proctosigmoidoscopy, and colonoscopy) is less controversial. But regardless of site, Steer and Silen from Boston suggest early endoscopy not be used in patients who are actively bleeding; in patients with well-documented peptic ulcer disease who stop bleeding soon after admission; in patients with known clotting disturbances; and in rebleeding patients who had their previously bleeding site amply identified.[83] However, "at the Mayo Clinic affiliated hospitals, virtually all patients with the possibility of upper gastrointestinal bleeding undergo endoscopy."[84] Thus, no guidelines have been widely accepted. Use of endoscopy remains up to individual clinical judgement.

2. Radionuclide Imaging. This nuclear imaging technology involves injection of radioactively-labelled compounds (e.g., ^{99m} Tc sulfur colloid, ^{99m} Tc pertechnetate red blood cells) which are released into the gastrointestinal tract during bleeding. The patient is then scanned; "hot spots" presumably identify sites of bleeding. These studies are popular because they are relatively non-invasive and low risk. Their drawbacks are two-fold: (1) they only identify hemorrhage sites if the patient is actively bleeding (at a rate of 0.1 ml per minute or greater); and (2) sites are only broadly identified (e.g., central abdomen). For these reasons, radionuclide imaging is generally used as a prelude to angiography.

3. Angiography. Angiography entails injecting radio-opaque contrast material into vessels supplying the gastrointestinal tract; x-rays are then taken to demonstrate contrast extruding at the bleeding site. To be accurate, the bleeding must be at a rate of 0.5 ml or greater per minute. Angiography can also identify abnormal vascular patterns which could be linked with hemorrhage, even if the lesion is not actively bleeding. Although angiography has a diagnostic accuracy of 50 to 75%, it is not without risk. These risks are even more worrisome in an elderly population with a high prevalence of atherosclerotic disease. Serious complications arise in about 2% of patients. However, similarly to endoscopy, angiography's appeal has transcended diagnosis by entering the therapeutic realm. Selective infusion of vasoconstrictive or vasoocclusive compounds through the angiography catheter may be helpful in halting hemorrhage from gastritis, ulcers, vascular malformations (more common in the elderly), and colonic diverticula. Angiographic treatment may be safer than surgical intervention. Thus, in many cases, diagnostic and therapeutic interests merge in angiography.

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83 Steer and Silen, p. 647.

84 David E. Larson and Michael B. Farnell, "Upper Gastrointestinal Hemorrhage," Mayo Clinic Proceedings 58 (1983): 372.

4. Barium Contrast Radiography. Conventional barium studies include the upper gastrointestinal barium swallow with small bowel follow-through and the barium enema. Their diagnostic accuracy is good, but still inferior to endoscopy. Also, lesions identified on a barium study (e.g., diverticuli) may not be the cause of the patient's bleeding. Because barium coats the lining of the gastrointestinal tract, neither endoscopy nor angiography can effectively be performed soon after barium testing. Therefore, barium studies are rarely used as the first-line, diagnostic tool for the active gastrointestinal bleeder. They are reserved for the more leisurely work-up of a slow, chronic bleed or a hemorrhage which has clearly ceased.

5. Exploratory Surgery. The most invasive diagnostic procedure is exploratory surgery. It is generally used only when all else fails. A patient undergoing such surgery would obviously be transferred to a procedural DRG.

The diagnostic armamentarium for assessing gastrointestinal hemorrhage is thus extremely broad. Despite this, exact diagnosis may remain elusive. For example, even if a lesion is identified, this is not proof that that particular process caused the hemorrhage (unless the lesion is actually caught in the act of bleeding). In one series of 1,400 patients with upper gastrointestinal bleeds and known lesions, half were found to be bleeding from sites other than the known lesions.[85] Furthermore, if diagnostic techniques one through four have no yield, even exploratory surgery is unlikely to be helpful. Unless the patient is at risk for exsanguination, it may be more prudent to delay further diagnostic testing, closely follow the patient as an outpatient, and repeat less invasive testing at a later date.

Therefore, a very wide range of discretionary resources may be invoked for evaluation of the patient with a gastrointestinal bleed. Numerous specialists and their technologies will have associated a broad spectrum of costs. There is little consensus in the medical community about the appropriate use of the major technology, endoscopy. Individual patients may have lesions which are difficult to identify, prompting repeated testing. One

85 Stuart J. Spechler and Elihu M. Schimmel, "Gastrointestinal Tract Bleeding of Unknown Origin," Archives of Internal Medicine 142 (1982): 236.

of the largest controversies involves the use of endoscopy in the setting of an acute upper tract bleed. Despite several studies which suggest no benefit from early endoscopic diagnosis, many physicians continue to perform the procedure. Part of the impetus is the physician's (and often patient's) need to know, knowledge for its own sake. Plus, albeit unproven, it makes sense that an accurate diagnosis would enhance choice of therapy. A major issue is to what extent does the reimbursement system wish to influence these decisions, particularly given the hoped-for improvements in therapy.

7.5 DIFFERENCES IN THERAPEUTIC APPROACH

The area of gastrointestinal hemorrhage is one in which diagnositc acumen may have surpassed therapeutic efficacy. Despite development of a plethora of therapeutic interventions, mortality from upper gastrointestinal tract hemorrhage has not decreased in the past 40 years.[86] Therefore, the issue is not so much one of therapeutic controversy as therapeutic frustration.

Initial treatment of the acutely bleeding patient raises little disagreement. The patient must first be adequately resuscitated and reasonably stabilized; the patient must simultaneously be evaluated as a candidate for emergency surgery. Type and extent of surgery remains controversial, particularly in the treatment of bleeding peptic ulcers. However, since surgery forces reassignment of the patient to a surgical DRG, discussion of these controversies shall be deferred.

There is also relatively little controversy about proper therapy for slowly bleeding lesions of certain types -- bowel malignancies, benign neoplasms. Surgery offers the only chance for cure. Timing of surgery is critically important. Surgical mortality increases several-fold in procedures performed emergently.

86 Larson and Farnell, p. 371.

What about patients who are at high surgical risk or who have lesions which do not respond well to surgery? These are the patients who by default receive medical management, ranging from relatively inexpensive antacid regimens to complex, specialized procedures. A host of new medical therapies have been developed to treat these patients. Several of the most recent technologies include arterial infusion of vasoconstrictive agents, endoscopic lasar photocoagulation, and tissue glues to coat ulcer craters. Appearance of each new therapy raises questions about its relative efficacy. Acceptance of these "advances" awaits properly controlled clinical studies; this may take many years.

Appropriate use of the myriad of therapeutic options is controversial even in common disorders such as bleeding peptic ulcers or nonvariceal upper tract bleeding. If emergent surgery is not undertaken, patients are conventionally placed on conservative medical regimens involving antacids and H_2-receptor antagonist drugs (to reduce stomach acid). "No study, however, has supported the therapeutic efficacy (in stopping active bleeding or decreasing the risk of rebleeding) of either type of agent."[87] Because these drugs have so few side effects, their use has been rationalized on this basis. What if the patient does not improve? At what point is failure of this conservative approach acknowledged? The decision timing could vary from days to weeks, depending on patient characteristics and the treatment philosophy of the individual physician.

One particularly illustrative example of frustration in treatment of gastrointestinal hemorrhage is therapy for bleeding esophageal varices. Esophageal varices may be alarmingly recalcitrant to all therapeutic interventions; no matter what one does, they may keep on bleeding. The following therapies may be successively tried in the acute setting:

87 Ibid., p. 373.

1. Administration of a vasoconstrictive agent (i.e., vasopressin) through a peripheral vein. Because the vasopressin will circulate widely through the bloodstream, it must be used carefully in patients with atherosclerosis. It is particularly dangerous for patients with coronary artery disease.

2. If the peripheral vein route fails, vasopressin can be directly administered to the arterial blood source. This requires selective catheterization of the superior mesenteric artery.

3. Tamponade of the bleeding varices by pressure of an intra-esophageal balloon. A specialized, balloon-equipped tube (the Sengstaken-Blakemore tube) has been created for this use. Because of the risk of pulmonary aspiration and of esophageal rupture during inflation of the balloon, only highly skilled persons should attempt this technique.

4. Endoscopic sclerosis of the varices. Sclerotherapy involves injection of a caustic material directly into the offending varix through the endoscope. The varix will become scarred thus obliterating flow of blood. It is a new technique requiring further study. Its complications include esophageal perforation, ulceration, and narrowing.

5. Emergency portacaval shunt surgery. Surgery is a therapy of last resort in treatment of bleeding esophageal varicies. If the patient is acutely bleeding, this operation presents a 25 to 50% risk of death.

As illustrated in the above example of therapeutic options for treatment of the acute variceal bleed, treatment of these patients can be an extremely frustrating experience. Fortunately, 85 to 90% of bleeders overall spontaneously stop. But those who do not stop or those who rebleed can be quite disconcerting. Thus, the issue is not as much therapeutic controversy as frustration with therapeutic options. This situation has prompted a continual quest for new therapies. Each new option must be properly evaluated, sometimes requiring years for full acceptance. The challenge is to create a reimbursement system sensitive to this need for changing technologies.

7.6 STATE DATA

The major issue raised in the preceding sections is the plethora of technologic options available for the work-up of gastrointestinal hemorrhage patients. The clinical suspicion is that different patterns of use of these numerous technologies may account for a portion of the cost variability observed in DRGs 174 and 175 (see Table 7.2). A further concern is that regional practice differences involving these technologies may contribute to a portion of the significant cost gap between New Jersey and North Carolina (see Table 7.3). This section uses the 1982 Medicare data to explore discretionary use of resources, descriptively highlighting differences within as well as between states.

TABLE 7.2

PART A AND B COST VARIABILITY: DRGS 174 AND 175

	PART A CV		PART B CV	
State	DRG 174	DRG 175	DRG 174	DRG 175
New Jersey	0.9430	0.9980	0.8210	0.7830
North Carolina	1.2650	1.1050	1.0020	0.8520

From the Part B perspective, physician specialty itself and use of consultations are important discretionary resources. As shown in Table 7.4,

TABLE 7.3

PART A AND B MEAN COSTS[a]

	PART A MEAN COST		PART B MEAN COST	
State	DRG 174	DRG 175	DRG 174	DRG 175
New Jersey	$2,617	$2,300	$734	$722
North Carolina	$1,986	$1,771	$431	$422

a New Jersey and North Carolina costs in all four columns are statistically significantly different at $p<.001$.

TABLE 7.4

SPECIALTY OF ATTENDING PHYSICIAN

(PERCENT OF CASES)

Specialty	DRG 174[a] New Jersey (N=3,170)	DRG 174[a] North Carolina (N=2,595)	DRG 175[b] New Jersey (N=752)	DRG 175[b] North Carolina (N=910)
General/Family Practice	18.4	34.5	16.5	38.4
Internal Medicine	55.4	53.1	53.7	55.9
Gastroenterology	7.6	1.6	11.8	0.6
General Surgery	7.6	7.8	8.9	4.0
Other	11.0	3.0	9.1	1.1
	100.0	100.0	100.0	100.0

a Chi-square comparison of New Jersey and North Carolina data yielded x^2=373.4, p<.001.

b Chi-square comparison of New Jersey and North Carolina data yielded x^2=436.3, p<.001.

New Jersey patients are more likely to have a specialist as attending physician than North Carolina patients. Despite this, more than twice as many New Jersey patients receive medical consultations as North Carolina patients. More New Jersey patients also obtain surgical consultations (see Figure 7.2). Although these purely cognitive services are important, perhaps even more costly is the resultant increase in number of tests ordered. A series of studies suggest that consultants tend to increase the use of expensive diagnostic technologies. These procedural services are particularly prominent in the area of gastrointestinal hemorrhage. For a preliminary view of the magnitude of this issue, the Medicare data were examined as follows:

> Data for DRGs 174 and 175 were combined for this analysis. The raw claims data were examined for Part B bills for specific services. Because the raw claims file was used, a number of cases are included which were subsequently discarded during the merging of the Part A and B files. This cleaning process is extensively discussed elsewhere.[88]
>
> New Jersey involved 4,218 patients and North Carolina involved 3,878 patients. For the purpose of this study, the unit of analysis is the patient, not the admission.[89] Twelve types of services were examined (see Table 7.5). State procedural codes were collapsed into these service categories. For example, New Jersey surgical service codes 3015, 3051, 3065, 3121, and 3124 comprise service type, "upper endoscopy without biopsy." Patients were then aggregated according to service type and service types were aggregated by patient.

In New Jersey, 3,349 (79.4%) of patients and in North Carolina, 3,003 (77.4%) of patients received at least one of the twelve services. As shown in Figure 7.3, more than 60% of patients receiving at least one service obtained

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88 See Sections 3.2 and 3.3 in Janet B. Mitchell _et al._, _Creating DRG-Based Physician Reimbursement Schemes: A Conceptual and Empirical Analysis_, HCFA Grant No. 18-P-98387/1-01, October, 1984.

89 The patient was chosen for two reasons: (1) the clinical question involved the range of services provided to individual patients for a particular bleeding problem, and (2) patients with multiple admissions may fall into several groups -- those who were readmitted within days of discharge from a prior gastrointestinal hemorrhage admission (thus having two hospitalizations for what may in fact be the same bleeding episode), and those who were readmitted weeks and months later. Even these late readmissions may be for the same bleeding source. Incorporating these factors would have made this analysis exceedingly complex. These issues may be important to examine at a later date.

TABLE 7.5

NUMBER OF PATIENTS OBTAINING SPECIFIC SERVICES; MEAN NUMBER OF SPECIFIC SERVICES PER PATIENT

	NUMBER OF PATIENTS[a]		MEAN NUMBER OF SERVICES PER PATIENT	
Type of Service	New Jersey	North Carolina	New Jersey	North Carolina
KUB[b]	1,148	857	1.47	1.47
UGI Series	1,596	1,745	1.19	1.12
Barium Enema	1,222	1,168	1.14	1.11
Abdominal CT Scan	100	95	1.29	1.15
Angiography	43	52	1.42	1.17
Nuclear Medicine	53	120	1.38	1.14
Upper Endoscopy Without Biospy	1,168	828	1.22	1.14
Upper Endoscopy With Biopsy	510	361	1.15	1.02
Colonoscopy Without Biopsy	654	284	1.27	1.15
Colonscopy With Biopsy	224	122	1.09	1.08
Proctosigmoidoscopy Without Biopsy	413	487	1.13	1.09
Proctosigmoidoscopy With Biopsy	42	36	1.29	1.03

a Chi-square comparison of New Jersey and North Carolina data yielded x^2=266.8, p<.001.

b "Flat plate" x-ray of the abdomen (comparable to a chest x-ray of the abdomen).

Figure 7.2

Percent of Patients Receiving
Medical and Surgical Consultations
GASTROINTESTINAL HEMORRHAGE DRGs

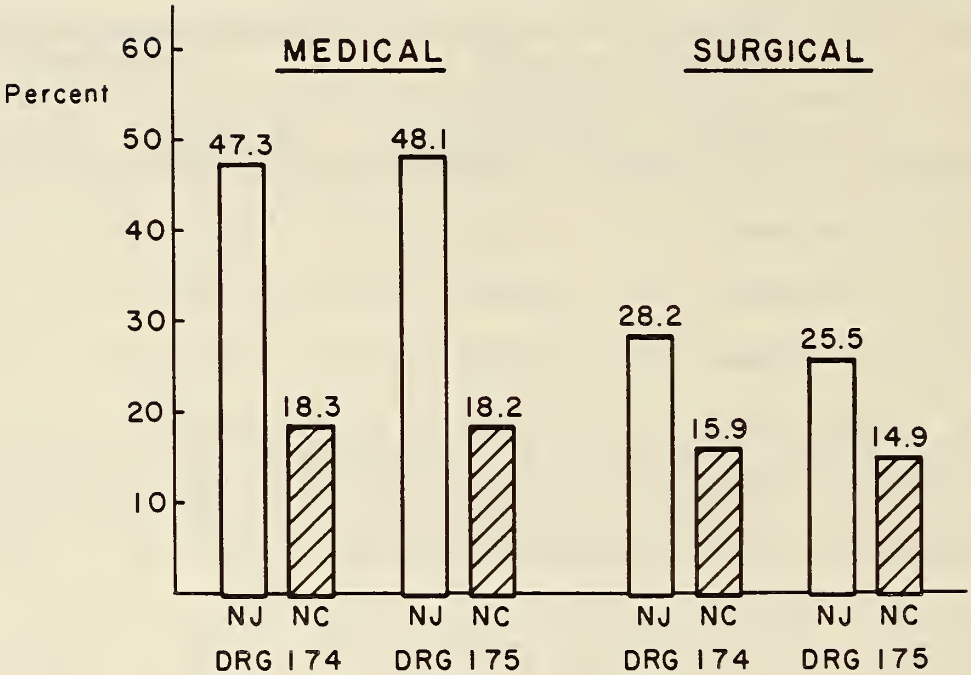
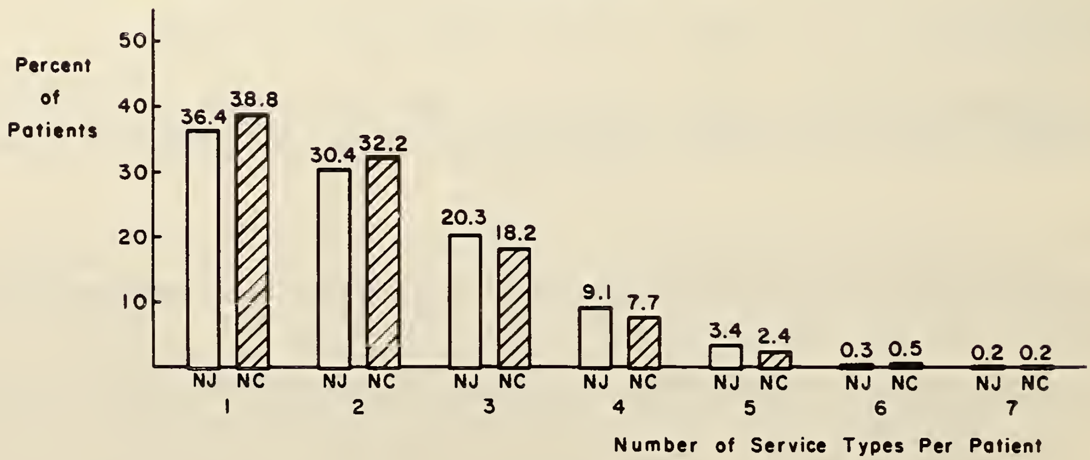


Figure 7.3
Percent of Gastrointestinal Hemorrhage Patients
Obtaining Multiple Service Types
N = 3349 in NJ
N = 3003 in NC



two or more types of services. The percentages of patients receiving multiple services are similar in New Jersey and North Carolina. Despite this, average length of stay is significantly longer in New Jersey than North Carolina -- by 2.19 days in DRG 174 and 2.21 days in DRG 175 (see Figure 7.4). Thus, North Carolina patients may be receiving multiple services in a shorter time span than New Jersey patients.[90]

Many services were provided to these 3,349 patients in New Jersey and 3,003 patients in North Carolina (see Table 7.5). The distribution of service types was significantly different in the two states. North Carolina patients were proportionately more likely to receive radiologic services -- conventional UGI series and barium enemas, and even abdominal CT scans, angiography, and nuclear medicine studies. However, New Jersey patients were more likely to get fiberoptic studies, upper endoscopy (esophagus, stomach, duodenum) and colonoscopy. Proctosigmoidoscopy, a less extensive exam, was more common in North Carolina. Of patients obtaining a particular service, the mean number of that particular service obtained by those patients in 1982 was always greater than one (see columns three and four in Table 7.5).

Tables 7.6 and 7.7 looks at the types of services obtained by patients.[91] In New Jersey, the most common exam for patients with one service type was

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90 If this is in fact the case, it may reflect several factors including the following: (1) greater immediate availability of technolgy in North Carolina (i.e., there are fewer waiting lists for procedures); (2) different mix of services (e.g., New Jersey uses more invasive procedures which require monitoring the patient for complications afterwards); and (3) different practice styles.

91 Tables 7.6 and 7.7 are constructed as follows: Rows represent service types. Columns represent numbers of different service types received by each patient. The number of patients receiving a given number of different services appears in the heading of each column. Each cell shows the percentage of patients obtaining a particular service. For example, in New Jersey 48.6% of the 1019 patients receiving two services received an upper gastrointestinal series. Each column adds to 100% times the number of service types received. For example, each of the 1,019 patients in New Jersey's column #2 are counted twice.

Figure 7.4
Length of Stay: Mean Plus and Minus One Standard Deviation
GASTROINTESTINAL HEMORRAGE DRGs

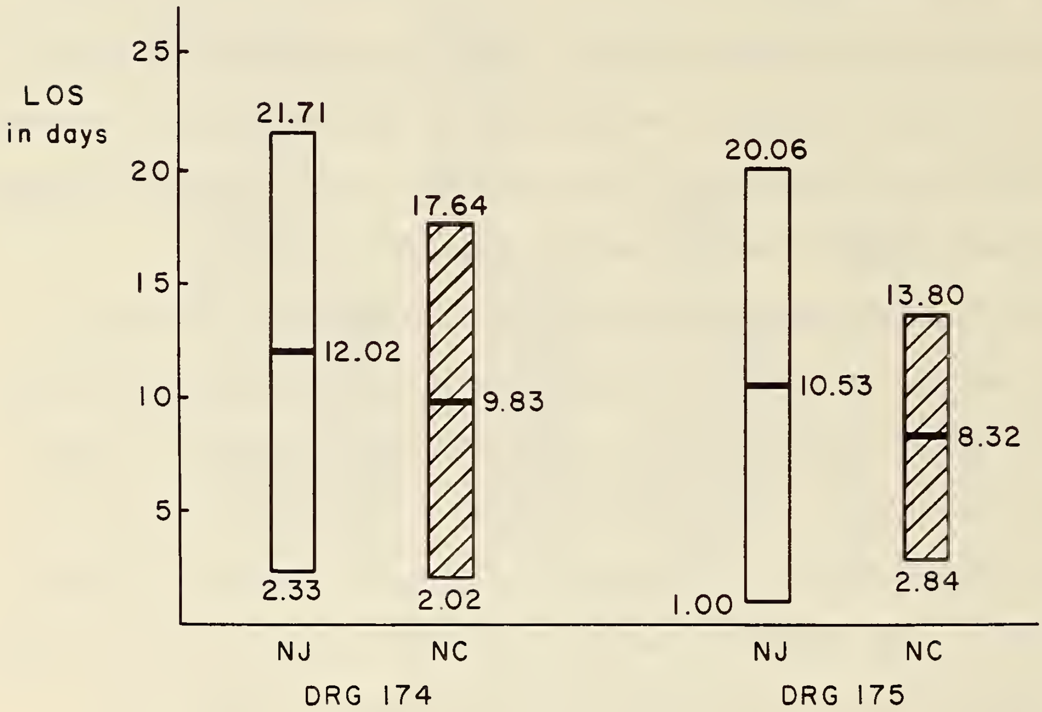


TABLE 7.6

SERVICE TYPES RECEIVED BY PATIENTS OBTAINING MULTIPLE

TYPES OF SERVICES: PERCENT OF PATIENTS

NEW JERSEY

	Number of Service Types Received by Patient						
Type of Service	1 N=1,218	2 N=1,019	3 N=679	4 N=305	5 N=113	6 N=10	7 N=5
KUB	13.3	29.8	53.5	66.9	88.5	100.0	100.0
UGI Series	22.1	48.6	70.0	80.7	87.6	70.0	100.0
Barium Enema	4.3	35.3	62.4	86.9	93.8	100.0	100.0
Abdominal CT Scan	0.6	1.9	4.3	6.6	18.6	20.0	40.0
Angiography	0.4	0.7	1.9	2.9	2.6	30.0	60.0
Nuclear Medicine	0.4	0.7	2.4	4.9	3.5	20.0	80.0
Upper Endoscopy Without Biospy	29.2	33.6	37.5	45.2	61.1	50.0	60.0
Upper Endoscopy With Biopsy	11.2	14.2	18.1	19.0	35.4	60.0	40.0
Colonoscopy Without Biopsy	8.0	18.2	23.3	44.6	60.2	70.0	40.0
Colonscopy With Biopsy	3.5	6.1	7.4	14.1	18.6	40.0	0.0
Proctosigmoidoscopy Without Biopsy	6.3	10.0	17.4	26.6	24.8	30.0	80.0
Proctosigmoidoscopy With Biopsy	0.7	0.9	1.8	1.6	5.3	10.0	0.0
Total Percent	100.0	200.0	300.0	400.0	500.0	600.0	700.0

TABLE 7.7

SERVICE TYPES RECEIVED BY PATIENTS OBTAINING MULTIPLE TYPES OF SERVICES: PERCENT OF PATIENTS NORTH CAROLINA

	Number of Service Types Received by Patient							
Type of Service	1 N=1,165	2 N=968	3 N=547	4 N=230	5 N=72	6 N=15	7 N=5	8 N=1
KUB	10.0	30.2	43.5	60.9	75.0	86.7	60.0	100.0
UGI Series	41.3	60.8	75.9	77.4	87.5	80.0	80.0	100.0
Barium Enema	6.7	43.0	72.4	84.7	91.7	80.0	100.0	0.0
Abdominal CT Scan	1.0	1.4	6.0	7.0	13.8	60.0	20.0	100.0
Angiography	0.5	1.4	2.0	4.8	8.3	13.3	40.0	100.0
Nuclear Medicine	1.0	3.0	6.0	8.7	23.6	33.3	80.0	100.0
Upper Endoscopy Without Biospy	22.5	25.6	30.5	42.2	54.2	73.3	80.0	0.0
Upper Endoscopy With Biopsy	7.9	12.7	15.7	18.3	15.3	26.7	40.0	100.0
Colonoscopy Without Biopsy	2.7	7.5	12.8	26.1	51.4	46.7	100.0	100.0
Colonscopy With Biopsy	1.1	3.4	4.8	11.7	20.8	46.7	20.0	0.0
Proctosigmoidoscopy Without Biopsy	5.0	10.1	28.2	55.6	54.2	33.3	80.0	100.0
Proctosigmoidoscopy With Biopsy	0.3	0.9	2.2	2.6	4.2	20.0	0.0	0.0
Total Percent	100.0	200.0	300.0	400.0	500.0	600.0	700.0	800.0

upper endoscopy without biopsy (29.2%), whereas in North Carolina, the most common service for patients with one service type was the upper gastrointestinal series (41.3%). In fact, in New Jersey 58.9% of patients received some form of endoscopy as their only service; in North Carolina the number was 39.5%. However, in both states, the two most common services for those obtaining two services were the upper gastrointestinal series and the barium enema. Comparable patterns are also observed in both New Jersey and North Carolina for patients receiving three, four and five services (the states have identical three, four and five most common services, although the rank order may not be the same).

Several combinations of services are expected to be particularly common. Table 7.8 explores this possibility. The most frequent combination in both states involves two radiologic services -- UGI series and barium enema. Services combining one radiologic and one endoscopic procedure are also common in both states, although less so in North Carolina. North Carolina patients were much less likely to receive two endoscopies.[92]

From this preliminary analysis, it appears that about half of the patients admitted to the gastrointestinal hemorrhage DRGs receive two or more different diagnostic services (50.7% in New Jersey and 47.4% in North Carolina). In some cases, multiple tests may be clinically indicated (to identify an elusive but troublesome bleeding site, for example). In others, the marginal yield of an extra diagnostic test may be minimal. Given that each of these technologies has substantial costs, differential use of these tests may have significant cost impact. Furthermore, as highlighted by the comparisons of New Jersey and North Carolina, this cost impact may incorporate important regional variations.

92 Chi-square analysis comparing numbers of patients receiving combined services in New Jersey versus North Carolina yielded x^2=37.38, p<.001.

TABLE 7.8

NUMBER (PERCENT) OF PATIENTS RECEIVING

SERVICE COMBINATIONS

Total N = 4,218 in New Jersey

Total N = 3,878 in North Carolina

	NEW JERSEY		NORTH CAROLINA	
Service Combination[a]	Number[b]	Percent	Number[b]	Percent
UGI Series, Upper Endoscopy	674	16.0	467	12.0
Barium Enema, Lower Endoscopy	613	14.5	517	13.3
UGI Series, Barium Enema	784	18.6	800	20.6
Upper Endoscopy, Lower Endoscopy	454	11.7	296	7.6
UGI Series, Barium Enema, Upper and Lower Endoscopy	135	3.2	98	2.5

a Upper Endoscopy = Upper Endoscopy with and without biopsy.
Lower Endoscopy = Colonoscopy and Proctosigmoidoscopy with and without biopsy.

b Some patients may have received three services and may therefore be counted twice.

7.7 IMPLICATIONS OF PROSPECTIVE REIMBURSEMENT FOR PHYSICIAN BEHAVIOR

Despite many technological advances, treatment of gastrointestinal hemorrhage remains a field in flux. Although the array of diagnostic and therapeutic tools is impressive, little improvement in patient outcome has been documented for the acute bleeder. The field is complicated by the random patient variables which may ultimately dictate the clinical approach -- the patient may spontaneously stop hemorrhaging or he may rebleed with life-threatening vigor.

DRGs 174 and 175 are extremely broadly defined. As currently constituted, they include both patients threatened by exsanguination and patients with slow, chronic bleeds. Many of the later group could safely receive outpatient evaluation (e.g., a barium enema followed by colonoscopy at an appropriate interval). However, the first group may be very costly to treat, requiring multiple interventions and intensive care unit monitoring. For this reason, "skimming" may prove an important practice for these DRGs. Since many of the patient variables which exacerbate costs are seemingly random, it may be difficult for physicians and hospitals to routinely accurately predict which individual patients may prove costly. There may be one class which have a particularly poor record -- chronic alcoholics with esophageal varices. Physicians may try to avoid these patients. Thus, "skimming" may be a significant concern and will prove a common thread through the ensuing discussion.

From the Part B perspective, consultations are a critically important issue. Physicians treating patients with gastrointestinal hemorrhage must work closely with other physicians. Particularly in the area of acute bleeds, there must be close cooperation among many types of physicians, especially internists, surgeons, and radiologists. Multiple specialists may also become involved: gastroenterologists, endoscopers, angiographers, nuclear medicine physicians, vascular surgeons, and so on. Sharing a single DRG fee among all these physicians may prove a sticky enterprise; the allocation between internists and surgeons alone may be extremely difficult.

In other areas (e.g., cerebrovascular disease) this shared fee issue may be dealt with by splitting admissions. However, in the setting of an acute gastrointestinal bleed, the options are not so straightforward. Discharging a patient still at significant risk for a rebleed would constitute medical malpractice. It is a difficult clinical call as to proper discharge timing for the recent gastrointestinal bleeder. Thus, the split admission practice would be medically defensible only for that subclass of patients who have slow, chronic bleeds or appear extremely stable. The practice of repeatedly admitting a patient for portions of work-up and therapy would be difficult to justify otherwise.

Paralleling this issue and related to the "skimming" concern, is the practice of transferring patients. General medical doctors and community hospitals may find themselves unwilling to care for these difficult patients. These patients may therefore be transferred to tertiary referral centers. This may place the medical specialist (i.e., gastroenterologist) at considerable risk. Because a patient who arrives as a transfer may have a particularly stubborn bleed, the gastroenterologist may be obliged to provide a very extensive intervention. The tertiary care hospital may offer the full range of physician specialists and subspecialists. The general medical doctor may be counting on the gastroenterologist to enlist the aid of these multiple physicians to treat the patient he transferred. Thus, the gastroenterologist may be forced to share the DRG fee among numerous colleagues whereas the general physician would not.

Once a patient is in a tertiary care setting, confronted by the full diagnostic and therapeutic armamentarium, what should be done if he rebleeds? Should alternative therapies be serially tried? To use the example from esophageal varices, if peripheral vasopressin fails, should intra-arterial vasopressin, then balloon tamponade, then emergency sclerotherapy be attempted? Under the prospective payment system, the pecuniary temptation is to halt after one or two interventions. But this is a very complex issue, reaching to the heart of medical ethics. It is extremely difficult for a physician to stand idle while a patient actively bleeds. The physician wants to do <u>something</u>. Plus the patient, the patient's family, and even the medicolegal system would frown upon inactivity in this setting. Even if therapies are experimental, unproven, and costly, the physician may be forced to intervene.

What about the other clinical example from the therapeutic approach section -- the nonvariceal bleeder who is placed on conservative antacid management? The point was made that a wide variety of time spans may be allowed to pass before the medical approach is deemed a failure and the patient is surgically treated. Because of the rebleeding risk, the patient must remain hospitalized while the benefits of this approach are evaluated (i.e., the admission may not be split). However, under prospective payment, the medical attending would receive the same fee whether the patient obtained surgery tomorrow or a week from tomorrow. The financial incentive would encourage earlier triage to surgery. Practice styles may be changed in the direction of earlier acknowledgement of failure of conservative medical therapy.

This discussion has focused upon the acute hemorrhage. Patients with slow, chronic bleeds present a different set of issues. They may be safely evaluated in outpatient settings (e.g., an ambulatory endoscopy unit for colonscopy) and may receive surgical consultations as outpatients. Hospitalizations uncomplicated by acute bleeds may be adequately managed by general medical doctors, without the flurry of consultations. Splitting admissions for subsequent surgical therapy may be clinically defensible. Finally, if "skimming" does take place, these are the perfect patients to select.

In summary, the area of gastrointestinal hemorrhage is complex. Many of the expected behavior changes from a prospective payment system may be thwarted by pressing clinical, ethical, and legal issues. For example, the impetus to deliver "cost-effective care" may falter when confronted by continually bleeding patients for whom only experimental interventions remain. Plus, this is a field in which the advances of several decades have failed to significantly improve mortality. This clinical challenge has stimulated development of numerous new therapies, many awaiting proper study. A DRG system would implicitly set practice norms by basing reimbursement upon today's widely-varying practice patterns.

7.8 SUMMARY AND CONCLUSIONS

Gastrointestinal hemorrhage is an important medical problem, requiring prompt attention. Several conditions common in the elderly -- diverticulosis, angiodysplasia, and bowel malignancy -- may often first present as gastrointestinal tract bleeding. The word "diagnosis" in the DRG title for these conditions is really a misnomer; they are more "symptom-related groups." Although most of the ICD codes defining DRGs 174 and 175 relate to a specific disease (peptic ulcer disease), the majority of the patients fall into catch-all ICD codes which merely denote that bleeding has occurred. These codes do not reveal why the bleeding happened.

This lack of diagnostic specificity is somewhat ironic in the face of the relatively vast and powerful array of diagnostic tools available for the work-up of these patients. Multiple technologies (and their related physician specialists) may be sequentially called upon. Despite the enhanced ability for early and accurate diagnosis, new therapeutic modalities have not appreciably improved mortality from the most dangerous type of bleed -- acute upper tract hemorrhage. Therefore, experimental treatments are continually being developed.

The high cost CVs evident in the New Jersey and North Carolina data could be easily related to these clinical concerns. Patients present with a wide range of clinical entities, roughly grouped by region into upper and lower tract processes. Although most patients stop bleeding spontaneously, 10 to 15% will persistently hemorrhage; an even larger number will rebleed. These patients are obviously more costly to treat than the chronic slow bleeder with melena as the primary clinical concern. Coequal to this broad severity spectrum in its cost implications is the issue of discretionary resources. Depending upon the clinical presentation and the work-up setting, the types and numbers of tests chosen could have major cost ramifications. The array of discretionary resources could easily account for a portion of the observed cost variation.

The 1982 Medicare data were used to explore the issue of use of multiple technologies to evaluate gastrointestinal tract hemorrhage patients. About half of the patients receive two or more different diagnostic services (50.7% in New Jersey and 47.4% in North Carolina). However, patients received a different mix of services in the two states. In New Jersey, 58.9% of patients received some form of endoscopy as their only service; in North Carolina the number was 39.5%. Combinations of endoscopic and radiologic services and multiple endoscopic services were more common in New Jersey. Thus, New Jersey patients were more likely to receive endoscopic services whereas North Carolina patients were more likely to receive radiologic services.

The area of hospital and physician incentives under the prospective payment system is complex and may well depend upon a constellation of clinical variables. The persistent acute bleeder and rebleeder present a plethora of medicolegal and ethical dilemmas which may be complicated by a rigid reimbursement structure. This issue of incentives may be broadly split by the severity of the hemorrhage. For example, the patient with the non-acute bleed may generate identical incentives for hospitals and physicians as follows:

1. Case Mix. Hospitals have an incentive to admit patients with marginal indication to cross-subsidize those more expensive to treat. Physicians would have the same incentive.

2. Transfers. Hospitals have an incentive to transfer to tertiary care centers patients who become less stable. Physicians would have the same incentive. These centers and their specialists thus assume all the risk.

3. Split Admissions. Hospitals have an incentive to release stabilized patients only to readmit them for elective therapy. Physicians would have the same incentives.

4. Earlier Triage to Surgery. If surgery appears an option, hospitals have an incentive to encourage performance of the operation as early as possible. Physicians would have the same incentives. This may mean that that group of patients who would have responded to prolonged (but nonetheless cheaper) conservative medical management would receive the more costly and risky surgical intervention.

5. Work-Up Setting. Hospitals have an incentive to shift expensive tests from an inpatient to an outpatient setting. Physicians would have the same incentive, particularly in encouraging outpatient consultations with a specialist.

6. Work-Up Intensity. Hospitals have an incentive to limit use of expensive diagnostic technologies. Physicians would have the same incentive. This may yield a significant subgroup of patients with negative initial work-ups who are treated empirically (e.g., with antacids).

But what about the patient at the opposite extreme: the acutely hemorrhaging patient who fails to respond to repeated interventions? The physician is directly confronted with a number of concerns: his professional frustration at the failure of conventional therapies; the ethic which compells him to do something rather than passively watching the bleed; the patient's and family's wishes; the omnipresent threat of medical malpractice suits. In this setting, what will be the influence of a reimbursement system which implicitly sets norms by fixing fees? The hospital in dealing with large numbers of patients may maintain a certain posture through pecuniary incentives. But the physician treating an identified patient may find pecuniary concerns overridden by professional ethic. Several examples are as follows:

1. Diagnosis. Hospitals have an incentive to limit use of diagnostic technologies. Physicians confronted by a patient persistently bleeding from an unknown source may have an incentive to vigorously pursue diagnosis.

2. Therapy. Hospitals have an incentive to limit use of therapeutic interventions. When confronted by a recurrently bleeding patient, physicians may have an incentive to try a full range of therapies.

3. Experimental Therapy. Hospitals have an incentive to limit therapies to proven, cost-effective modalities. Once conventional treatments have failed, physicians may have an incentive to attempt new, experimental therapies.

4. Intensive Care Unit Monitoring. Hospitals have an incentive to constrain intensive care unit stays of their patients. However, if the patient appears only marginally stable, the physician may have an incentive to prolong the stay.

Thus, the potential impact of the prospective payment system upon treatment of gastrointestinal hemorrhage is not a clear cut issue. It is swayed by the exigencies of clinical presentation, setting of care, and ethical/legal concerns. The great challenge to the reimbursement system is to remain sensitive to these multiple issues and to maintain quality of care.

Chapter 8

DIABETES MELLITUS: MEDICAL DRGS

DRG 294: Diabetes Age $\geq$ 36

DRG 295: Diabetes Age 0-35

8.1 INTRODUCTION

Diabetes mellitus (DM) is a disease of disordered glucose metabolism. It claims many victims: more than 10 million Americans are thought to suffer from diabetes mellitus, and the disease is blamed for 40,000 deaths annually. Mortality statistics reflect only a portion of the ravages of the disease. Diabetes mellitus is responsible for other significant morbidities. Atherosclerosis is accelerated in diabetics, doubling the risk of coronary heart disease, stroke, and peripheral vascular disease. Diabetes mellitus also causes renal and nervous system damage. It is the leading cause of new blindness in the country. Thus, the costs of diabetes mellitus in terms of shortened life expectancy and morbidity are enormous.

The New Jersey and North Carolina statistics reflect this impact. DRGs 294 and 295 include 4,551 cases in New Jersey and 4,714 cases in North Carolina. The costs are similarly high. Total Part A and B costs for the two DRGs were $13,266,437 in New Jersey and $9,296,926 in North Carolina. Given these high costs, the amount of cost variation within the DRGs may be similarly important; both Part A and B CVs are high. DRG 294 is more significant from both the cost and caseload perspective. In New Jersey, Part A CV is 1.0180, and Part B CV is 0.8770. In North Carolina, Part A CV is 1.0890, and Part B CV is 0.9440.

The origin of some of this cost variation can perhaps be found in a clinical analysis. The arguments flow along several levels:

1. Each of the DRGs contains a variety of clinical entities although they all stem from a single process, diabetes mellitus;

2. Each clinical entity can present with vastly varying degrees of severity; and

3. Each clinical entity requires its own specific diagnostic and therapeutic approach.

A possible fourth level involves the interaction of the psychosocial dynamics of the patient himself. Diabetes mellitus is a disease uniquely affected by patient behavior (e.g., diet, modification of insulin dose). The dictates of patient attitudes and aptitudes may even shape activities during hospitalization. Diabetics are more often appropriately involved in directing extent of work-up and therapy, founded upon their own particular treatment philosophies. Individual patients may be more or less aggressive in relationship to their disease, and thus generate different costs for a given level of illness. This chapter examines these complex clinical issues.

8.2 DEFINITIONAL PRECISION

On the surface, DRGs 294 and 295 seem very precisely defined: they both encompass a single disease, diabetes mellitus. However, the epidemiologic and pathophysiologic perspectives often distinguish two distinct types of diabetes, Type I ("juvenile onset," insulin dependent) and Type II ("adult" or "maturity onset," non-insulin dependent). These variants are contrasted in Table 8.1. Although they both lead to such complications as accelerated atherosclerosis and neuropathy, they also have their own unique targets: the retinal and renal microvasculature for Type I and the peripheral macrovasculature for Type II. They also tend to generate specific types of emergencies: diabetic ketoacidosis for Type I and hyperosmolar coma for Type II. From the clinicians' perspective, sometimes these margins blur. For example, elderly diabetics may develop blindness and renal failure. However, the differences in initial therapeutic approach remain. Type I diabetics

TABLE 8.1

CLINICAL FEATURES OF DIABETES MELLITUS

Clinical Variable	Type I Diabetes Mellitus	Type II Diabetes Mellitus
Control of Blood Glucose	Requires exogenous insulin to prevent death	May not require insulin; blood glucose may be controlled by oral hypoglycemic agents, dietary modifications, exercise, weight loss
Risk Factors	No clear-cut genetic inheritance; occurs equally in men and women; may be related to a viral infection; occurs in young persons (formerly called "juvenile onset diabetes")	Clear-cut genetic inheritance; occurs more in women than men; related to obesity (80% of patients obese at time of diagnosis); occurs in older persons (formerly called "adult or maturity onset diabetes")
Onset of Symptoms	Usually abrupt onset of symptoms (weight loss, excessive fatigue, polyuria, polydipsia); often diagnosis made when patient presents with diabetic ketoacidosis	Usually insidious onset; elderly persons may be aymptomatic; in addition to the classic symptoms of frequent drinking and urination, patient may also experience symptoms of reactive hypoglycemia (sweating, palpitation, tremor, weakness)
Diabetic Ketoacidosis	Common; often precipitated by withdrawal of insulin or stress	Rare
Hyperosmolar Coma	Rare	Common; often precipitated by extreme stress usch as myocardial infarction, stroke, sepsis, kidney failure

TABLE 8.1 CONTINUED

Clinical Variable	Type I Diabetes Mellitus	Type II Diabetes Mellitus
Microvascular Complications: Retina, Kidney	Develops in most patients -- almost inevitable in patients who have been diabetic for 20 or more years; renal failure is a leading cause of death in these patients	Not a major complication
Macrovascular Complications: Accelerated Atherosclerosis	Develops early in life, but pace of macrovascular problems appears independent of microvascular complications	A major cause of morbidity and mortality for these patients, atherosclerosis may be more severe than for Type I, and affects particularly the lower extremities and cerebral vessels
Diabetic Neuropathy	A common problem for both types; see discussion under Type II	The most chronic complication: for example, polyneuropathy (clinically sensory impairment generally of lower extremities) present in two-thirds of adult diabetics; impotence (due to autonomic dysfunction) present in one-half of male diabetics over age 50

always require insulin injections, whereas Type II diabetics may often be managed by oral hypoglycemic drugs, diet, weight loss, and exercise.

From the ICD code vantage, these DRGs appear very precisely defined. Of the 19 ICD codes which comprise each of these DRGs, 18 have identical first three digits, 250.[93] The issue of Type I versus Type II diabetes mellitus is dealt with by addition of a fifth digit: 0 if "adult-onset or unspecified as to type," and 1 if "juvenile type." The situation of diabetes mellitus is somewhat unique in the ICD coding rubric. The ICD-9-Clinical Modification volume groups together under the same three-digit heading all the protean manifestations of diabetes mellitus -- ranging from the emergency of diabetic ketoacidosis (Code 25010) to the predictable sequelae of long-standing diabetes (Code 25040: Renal Manifestations; Code 25050: Ophthalmic Manifestations; Code 25060: Neurologic Manifestations; Code 25070: Peripheral Circulatory Disorders). This grouping of expected complications in one place is different from the more scattered approach accorded other chronic diseases with predictable other-organ involvement. For example, both systemic lupus erythematosus (Code 71000) and sickle cell anemia (Code 28260) have well-recognized, specific complications, but these complications would be coded under the other organ system (e.g., bone, kidney) not under the lupus or sickle cell code. Thus, the Clinical Modification system has attempted to yield some clinical cohesiveness to the coding of diabetic disorders.

Therefore, DRGs 294 and 295 include not only patients with uncomplicated diabetes but also patients with acute problems (coma, ketoacidosis) and patients with chronic problems in other organ systems (kidney, peripheral vasculature). Although each of these presentations relates to the single

93 The 19th code is Code 79150: Glycosuria (glucose in the urine). This laboratory finding is suggestive of diabetes mellitus and is therefore grouped in these DRGs. However, no patients in either New Jersey or North Carolina fall into this coding category.

disease, diabetes mellitus, they all really respresent unique clinical entities. For example, the clinical approach to the person in hyperosmolar coma is very different from the approach to the patient with gangrene of a toe.

This problem is not simply one of differing levels of severity, as the above example implies. If the comparison were made instead between a Type II diabetic with hyperosmolar coma and a Type I diabetic who is blind and suffers from chronic renal failure, the margins become blurred. The patient in coma confronts an acute risk of death with short-run high costs; the other patient faces a chronic problem with long-run high costs. Which condition is more severe? It may be conceptually more accurate to view these as separate clinical entities (yielding imprecision in the definition of these DRGs), rather than as a scatter of points along the severity continuum.

Thus, the issues of definitional precision and severity of illness overlap in these DRGs. For clarity of discussion, however, the different clinical entities and their relative severities will be further described in the next section, "Severity of Illness."

The New Jersey and North Carolina data on caseloads by ICD codes in DRGs 294 and 295 are very interesting (see Figure 8.1). The statistics suggest that New Jersey and North Carolina are treating different patient types! For example, DRG 294, diabetics aged greater than 35, supports the largest volume (4403 cases in New Jersey and 4635 cases in North Carolina). In New Jersey, 58.9% of cases fall into ICD Codes 25090 and 25091: diabetes <u>with</u> an unspecified complication. In North Carolina, 79.1% of cases fall into Code 25000: diabetes <u>without</u> complication. Only 17.2% of New Jersey patients fall into this uncomplicated Code 25000, and only 12.3% of North Carolina patients fall into Code 25090, unspecified complications.

Figure 8.1A
Five Most Common ICD Diagnoses
in DRG 294

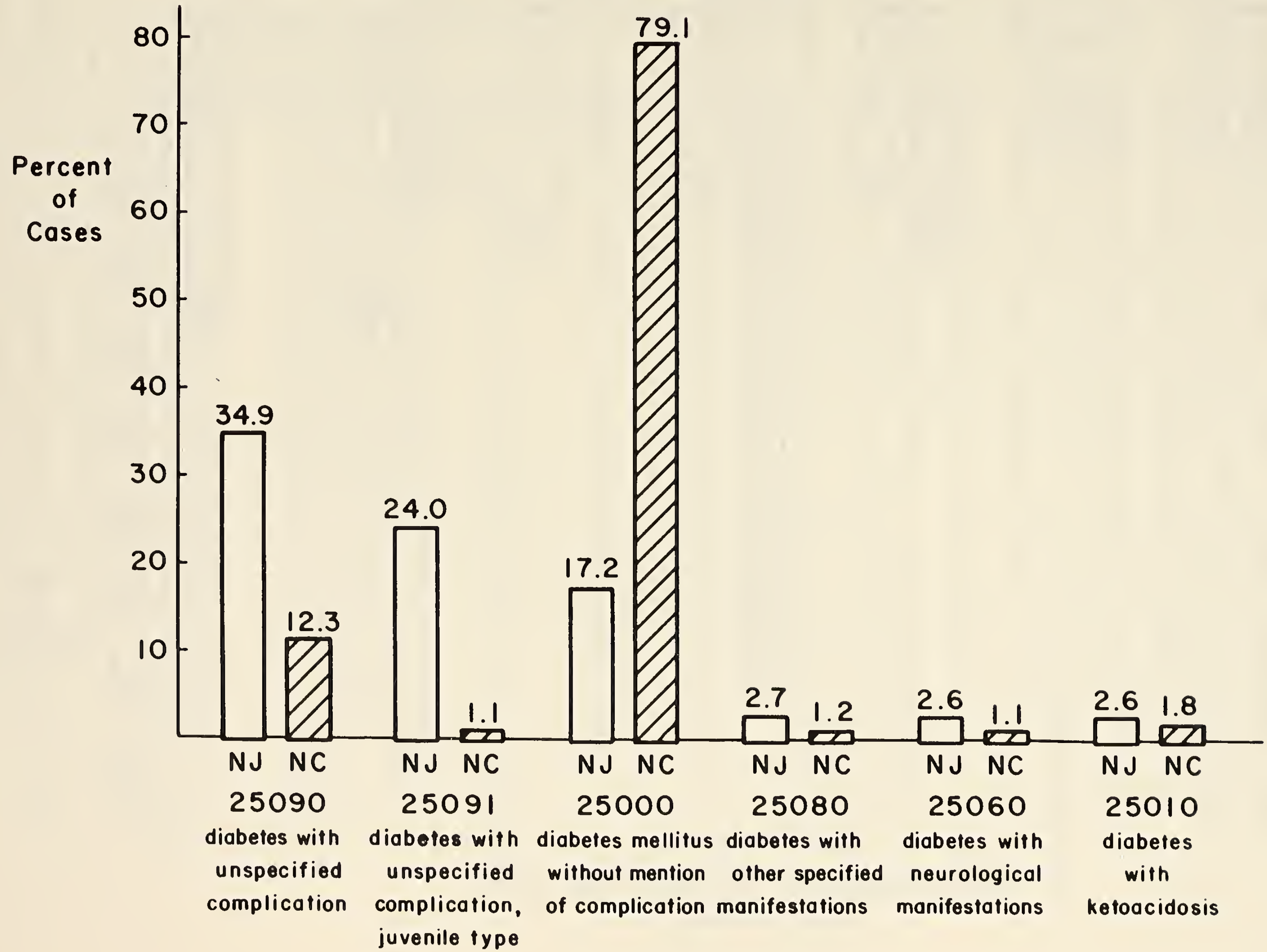
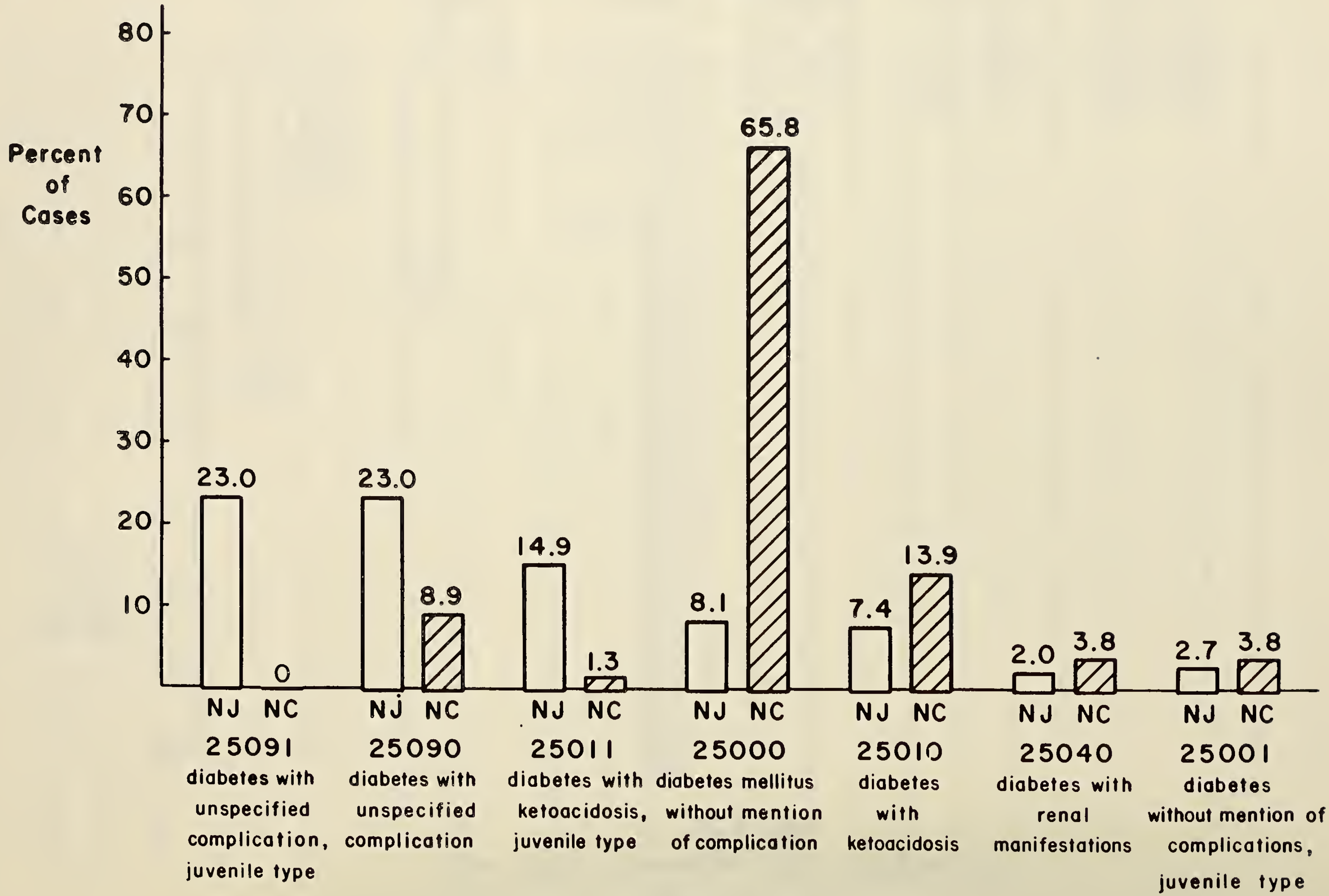


Figure 8.1B
Five Most Common ICD Diagnoses
in DRG 295



In DRG 295 the parallel pattern emerges (DRG 295 accounts for 148 cases in New Jersey and 79 cases in North Carolina). Almost half of New Jersey patients (46%) have an unspecified complication; 65.8% of North Carolina patients are without complication. The percentage of patients with the complication of diabetic ketoacidosis is also different in the two states (22.3% in New Jersey and 14.2% in North Carolina). North Carolina appears to be more careful in coding the type of diabetes mellitus in DRG 295. The age cut-off of this DRG virtually restricts it to Type I patients. North Carolina patients are coded as "juvenile onset" diabetics, while New Jersey patients are coded as having "adult or unspecified onset" diabetes mellitus. Given the age constraints, the New Jersey patients are probably coded in this manner because onset is unspecified.

Therefore, from the ICD code data, it appears that the majority of the New Jersey diabetics have complications whereas the majority of North Carolina diabetics do not. What accounts for this difference? Several possible explanations are as follows:

1. New Jersey patients are in fact sicker than North Carolina patients. This seems unlikely.

2. New Jersey and North Carolina follow different coding styles. Clearly New Jersey is not as careful about specifying the type of diabetes as North Carolina is. Although the ICD codebook incorporates most complications under the diabetes code, North Carolina could be ignoring this rubric. For example, North Carolina could be grouping its diabetics with renal failure under a renal code.

3. New Jersey and North Carolina follow different therapeutic philosophies, with North Carolina admitting more minimally affected patients for early interventions, such as diabetic teaching. Given the data constraints, it is impossible to evaluate the impact of practice style variations, but it seems unlikely that this factor alone could account for such systematic differences.

If indeed the ICD codes accurately reflect the clinical status of the patients in the two states, this could have significant financial implications: complicated patients are more costly to treat than uncomplicated patients. Because of its potential cost impact, this issue may merit further scrutiny.

8.3 SEVERITY OF ILLNESS

Patients with diabetes mellitus may span the severity spectrum. At one end is so-called "chemical diabetes," in which the patient is asymptomatic but shows evidence of disordered glucose metabolism on laboratory evaluation. At the other end is the emergency of hyperosmolar coma which is often lethal. However, as mentioned in the previous section, the issue is not simply one of varying levels of severity. Diabetes may manifest in a variety of clinical entities; each entity may appear in a more or less severe form, and each entity may be more or less severe than another. In some cases the comparison may not be clear-cut (as in the prior example comparing a patient in hyperosmolar coma with a blind patient in renal failure). These multiple issues may be conceptualized across three dimensions as follows:

Dimension 1. Day-to-day control of blood sugar. Adequate blood sugar control is essential to prevent an acute life-threatening event; there is some debate as to whether tight blood sugar control also lessens the destruction of the chronic complications of the disease. Regardless, some patients are easy to control and others are difficult. At one end of the spectrum is the Type II diabetic who regulates his blood sugar by dietary modifications and weight loss. At the other end is the "brittle diabetic," generally with Type I disease, whose blood sugar is extremely labile. These patients are extremely sensitive to slight shifts in insulin dose, diet, or exercise, and are prone to diabetic ketoacidosis. These patients may require frequent hospitalization and intensive teaching and monitoring.

Dimension 2. Acute Complications. See Table 8.2. There are three major life-threatening acute complications associated with diabetes: diabetic ketoacidosis (DKA); hyperglycemic, hyperosmolar, nonketotic coma; and insulin-induced hypoglycemia. If allowed to progress, each will result in death. But if caught early, each may be relatively easy to correct. For example, a Type I diabetic who has previously experienced DKA will know the symptoms, and may seek care early in the process. However, another patient may not even be aware he has diabetes. He may lapse into shock before he has a chance to enter a hospital. This patient may require ventilatory support and intensive care monitoring. Thus, there is a broad spectrum of severity associated with even such lethal complications as DKA.

TABLE 8.2

COMPLICATIONS OF DIABETES MELLITUS

Complication	Type of Diabetes Mellitus	Clinical Presentation	Therapy
1. Acute			
a. Diabetic Ketoacidosis (DKA)	I	May develop slowly over days or precipitously over hours. It carries a 6 to 10% mortality rate. Insulin deficiency leads to hyperglycemia, manifest clinically by nausea, vomiting, inability to take food or fluids, weakness, and mental torpor. Coma and shock are late presentations. Diagnosis easily made on history, physical exam, and laboratory finding of low pH and elevated glucose and acetoacetic acid.	Goal of therapy is to redress metabolic derangements and fluid imbalance. Insulin must be administered and the patient carefully monitored for shifts in pH, glucose level, potassium, and other electrolytes, as well as clinical parameters such as pulse, blood pressure, and urine output. Depending on severity of DKA, patient may require close supervision in the intensive care unit.
b. Hyperglycemic, Hyperosmolar, Non-ketotic Coma (HHNC)	II	Considered the most lethal complication of diabetes mellitus with death rates from 40 to 70%. Commonly found in elderly, previously undiagnosed diabetic, who is stressed by an underlying disease (such as heart attack, stroke, sepsis, renal failure). Insidious onset often delays recognition of problem until patient becomes comatose. Patients present profoundly dehydrated, with decreased alertness and various neurologic changes. Diagnosis made by laboratory findings of high serum osmolality and glucose in the light of slight or no acidosis and slight or no ketonemia.	Goal of therapy is to restore gluids and electolytes to normal. Requires both insulin and fluids. There is some controversy as to rate and way to correct profound dehydration. Particularly patients with underlying cardiac disease may require central venous pressure monitoring during fluid restoration, necessitating admission to an intensive care unit. Respiratory arrest, convulsions, aspiration, and severe electrolyte imbalances may occur, making intensive care unit admission desirable even in non-cardiac cases. Must also find and treat precipitating disease.

TABLE 8.2 CONTINUED

Complication	Type of Diabetes Mellitus	Clinical Presentation	Therapy
c. Insulin-Induced Hypoglycemia	I > > II	A risk in all insulin-dependent diabetics. May be caused by skipping meals, exercise, errors in insulin dose, alcohol consumption, etc. Symptoms vary, but may include headache, sweating, increased heart rate, somnolence, weakness. May lead to brain damage, heart attack, and even auto accidents.	Goal of therapy is to restore blood sugar, often by ingestion of a concentrated glucose solution or sugar source. For severely hypoglycemic patients, glucose intravenously and glucagon injections are required. Education and prevention are key.
2. Chronic			
a. Retinopathy	I > > II	Leading cause of new blindness in United States; degree of retinopathy proportional to length of time with diabetes. Blindness caused by "proliferative retinopathy," in which blood vessels grow into the previously non-vascular vitreous chamber of the eye. Glaucoma also more common in diabetics. Diabetics should be closely followed by an ophthalmologist to identify problems at an early stage.	If caught early, vascularization of the vitreous can be controlled by periodic photocoagulation. The blue-green beam of the argon lasar is particularly suited to this task. In patients with severe vitreous neovascularization, a 50% improvement can be hoped for by a pars plana vitrectomy.
b. Renal Failure	I > > II	Leading cause of death in patients with Type I diabetes mellitus. Increased in cigarette smokers. Patient may be asymptomatic, with only evidence in urine of failure (protein, casts, etc.), or may present with full-blown nephrotic syndrome, edema, and hypertension.	No specific therapy. Patients may progress rapidly to require chronic hemodialysis or peritoneal dialysis. In younger patients, renal transplant from a living, related donor is an option. Insulin dose may require modification as renal failure progresses.

TABLE 8.2 CONTINUED

Complication	Type of Diabetes Mellitus	Clinical Presentation	Therapy
c. Accelerated Atherosclerosis	II > I	From microscopic perspective, atherosclerotic plaques in diabetics are identical to those in non-diabetics. However, the atherosclerotic process is sped up in diabetics. Patients are thus prone to early coronary artery disease (heart attacks, angina), cerebral vessel disease (stroke, TIAs), and peripheral vascular disease (claudication, gangrene).	No specific therapy. Must treat each atherosclerosis-related event as it appears, as in a non-diabetic.
d. Neuropathy	I, II	Most common complication of diabetes mellitus. May involve virtually any portion of the nervous system, including peripheral nerves, visceral nerves, autonomic nerves, and cranial nerves. Each nerve type will have its own classic clinical presentation. Several clinical syndromes include: a sensory loss in the stocking-glove distribution; carpal tunnel syndrome; weakness and muscle-wasting; sexual impotence; bladder dysfunction; painless heart attacks; problems with gastric emptying; intractable diarrhea; postural hypotension; and abnormal sweating.	Little specific therapy is available. Certain drugs may be helpful for gastric emptying delays, diarrhea, and postural hypotension, but individual patient response is problematic. Because of incidence of painless heart attack, must be very suspicious of cardiac disease even in asymptomatic patient. Surgery for carpal tunnel syndrome may provide some relief. Education for proper foot and skin care critical.

TABLE 8.2 CONTINUED

Complication	Type of Diabetes Mellitus	Clinical Presentation	Therapy
e. Increased Susceptibility to Infections	I, II	Certain infections are more prevalent in diabetics. Skin infections in particular are closely related to loss of sensation due to neuropathy. Necrotizing skin infections and gangrene of feet and legs may prove lethal. One infection particularly common in elderly diabetics is "malignant external otitis" (infection of the external ear). It is termed malignant because of its rapacious course; mortality is 50%.	Therapy consists of antibiotics and surgical debridement and amputation when necessary. A patient with malignant external otitis requires a many-week course of intravenous antibiotics. Prevention and teaching of good foot and skin care of obvious importance.

Dimension 3. Chronic Complications. See Table 8.2. Diabetes wreaks havoc on most of the organ systems of the body. By 15 to 20 years after the original diagnosis, virtually all diabetics will have at least one of the major complications of the disease. Certain complications are important causes of death (e.g., renal failure); others are major sources of disability (e.g., retinopathy, neuropathy). Each complication may present along a severity continuum. For example, a patient with renal involvement may be asymptomatic or may require hemodialysis. But it may be difficult to compare complications across a severity continuum (e.g., how can one compare partial blindness with amputation of a lower extremity?).

DRGs 294 and 295 lump together all diabetics. As this clinical discussion shows, this will yield an exceedingly heterogenous group of patients. This clinical heterogeneity may easily generate substantial cost variability. For example, the new onset Type I diabetic admitted for initial insulin control and diabetic teaching will have different costs from the patient with renal failure who presents with full-blown nephrotic syndrome. Each may have different costs from the comatose patient requiring intensive care unit monitoring. Thus, for these DRGs, both the multiplicity of clinical entities and the wide range of severities have significant implications.

8.4 DISCRETIONARY USE OF RESOURCES

Because diabetes mellitus is such a common illness, most physicians are accustomed to seeing patients with the disease. The diagnosis is often made on the basis of history (polyuria, polydipsia, fatigue, weight loss), a positive family history (Type II), physical exam (obesity, sensory loss, eye findings), and easily confirmed by measurement of blood glucose. In most cases, this constitutes a straightforward, outpatient work-up. There are two exceptions: those worrisome patients who present first with an acute complication (children with DKA and elderly with hyperosmolar coma). These patients obviously require prompt hospitalization.

If routine blood glucose measures are borderline (one- or two-hour postprandial), an oral glucose tolerance test (OGTT) may be required. This is generally a three-hour test performed after the patient has completed a strict 12-hour fast. The OGTT is also safely performed in an outpatient setting. Once a diagnosis of diabetes mellitus is confirmed, a host of outpatient resources may be mobilized to care for the diabetic over his lifetime. Such resources include dieticians, podiatrists, and nurses specializing in diabetic teaching, as well as general medical doctors, diabetologists (subspecialized endocrinologists), and ophthalmalogists. Although most of these services are easily rendered on an outpatient basis, they are mentioned here because they are typically services for "uncomplicated" diabetics (patients who would seem a priori not to require hospitalization). As shown in Figure 8.1, 79.1% of North Carolina's and 17.2% of New Jersey's DRG 294 caseload are "adult-onset" diabetics without mention of complications. Who are these patients, and what services are they receiving? Are they receiving these standard outpatient services in an inappropriate inpatient setting? This question will be discussed further in the section on implications of the PPS.

Once a patient is hospitalized, a variety of resources may be called upon for their care. Potential physician consultants include endocrinologists, diabetologists, surgeons, dermatologists, infectious disease specialists, nephrologists, and gastroenterologists. The use of intensive care unit specialists may depend on the staffing pattern of the hospital. For example, in a teaching hospital, house officers and medical students can watch a patient in DKA meticulously on a regular floor. In a community hospital with less staff, such patients may be best treated in an ICU.

As mentioned earlier, the work-up of diabetes mellitus per se is not technologically expensive. But the evaluation of multi-organ complications may prove exceedingly costly. Multiple diagnostic technologies may be invoked -- from angiography to evaluate peripheral vascular supply; to gastric motility studies to assess stomach emptying; to renal biopsies to document the extent of kidney damage and evaluate suitability of renal transplant. The use of these technologies may vary widely from patient to patient, depending not only on the extent of complication in a particular organ but also on the overall treatment philosophy of the individual patient and physician.

In summary, the preliminary diagnosis and work-up may generally be accomplished as an outpatient and is comparatively inexpensive. Once admitted, a patient may be evaluated by a number of specialists and by using a number of expensive technologies. In some sense, use of these resources may not be discretionary but may be dictated by the exigencies of the patient's complications (for example, a surgeon may be needed to debride an infected wound). However, in another sense, the level of aggressiveness with which to pursue evaluation of certain complications may be very much up to the individual patient in discussion with his physician. Differences in management philosophy may yield differences in intensity of discretionary resource use independent of level of severity or type of clinical entity.

8.5 DIFFERENCES IN THERAPEUTIC APPROACH

The cornerstone of diabetic therapy is control of blood glucose. The discovery of insulin in 1922 allowed physicians to prevent and treat the lethal acute complications of the disease. But how much has the natural history of the illness and its sequelae been altered by the use of insulin?

> More than half a century later, it is evident that the use of insulin has not resulted in a cure for diabetes. Instead of succumbing to ketoacidosis, now patients often die at an early age of cardiovascular and renovascular disease...A significant decrease in life expectancy was found irrespective of the age at which diabetes was acquired.[94]

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94 Solomon A. Kaplan *et al.*, "Diabetes Mellitus," *Annals of Internal Medicine* 96 (1982): 635.

Despite these sobering mortality and morbidity statistics, none would argue that insulin not be used in diabetics. Debate now centers on how insulin should be used. At issue is the "tightness" of blood sugar control. In patients under "tight" control, blood sugar approximates as closely as possible the peaks and troughs experienced by normal individuals. This is achieved by multiple daily insulin injections and compulsive patient self-monitoring. The immediate risks are of insulin-induced hypoglycemia and resultant potential brain damage. What are the benefits? This question formed the focus of a debate waged in the late 1970s.[95,96] To this day, the issues are not clearly resolved.

Treatment philosophy may dictate admission patterns, lengths of stay, and resource use during hospitalization. For example, a physician who believes in tight control may be more likely to admit a patient for diabetic teaching (not for treatment of a specific event), to require multiple blood tests, and to keep the patient in the hospital longer. It is impossible to ignore the major role the patient also plays in the approach towards his illness. Some diabetics wish to maintain tight control. They are highly motivated to learn self-monitoring techniques and adjustments of insulin dosage; they maintain strict dietary standards. Other diabetics, such as a newly-diagnosed elderly person, may not feel the sense of urgency for control experienced by a younger person. These patients may refuse to administer insulin injections to themselves or may decide that they just do not wish to alter their diets. Just as talents vary in the nondiabetic population, patients with diabetes display a range of aptitudes for diabetic teaching. Some patients are quick

95 George F. Cahill, et al., "'Control' and Diabetes," New England Journal of Medicine 294 (1976): 1004.

96 Franz J. Inglefinger, "Debates on Diabetes," New England Journal of Medicine 296 (1977): 1228.

to learn, while other patients take more time, requiring longer hospitalizations.

Thus, differences in therapeutic approach results from a composite of physician treatment philosophy and patient attitudes. Even patients with identical blood sugar profiles and identical complications may generate widely divergent costs due to differences in approach. It is possible that these differences underlie a portion of the cost variation in DRGs 294 and 295.

8.6 STATE DATA

The preceding discussion highlighted several clinical issues. This section uses the 1982 New Jersey and North Carolina Medicare data to look at two of these concerns:

1. Differences between the states in their treatment of diabetes patients; and

2. The possibility of splitting the DRGs along clinically appropriate lines to create more homogeneous cost categories.

8.6.1 Differences Between the States

As mentioned in the definitional precision section, New Jersey and North Carolina appear to be treating different types of patients -- at least patients with different ICD codes. The largest group in New Jersey falls into an ICD code for complicated diabetes mellitus; the largest group in North Carolina falls into an ICD code for uncomplicated diabetes mellitus. This difference is not readily explicable from a clinical perspective. The most likely reason is idiosyncratic differences in ICD coding styles. However, the states certainly do have different costs for treating diabetes mellitus patients.

Table 8.3 demonstrates that New Jersey is significantly more costly than North Carolina. For example, the average New Jersey physician receives $230 more than the average North Carolina physician treating a patient in DRG 294.

TABLE 8.3

MEAN PART A AND B COSTS FOR DIABETES MELLITUS DRGS

	DRG 294		DRG 295	
State[a]	Part A	Part B	Part A	Part B
New Jersey	$2,391	$533	$2,200	$460
North Carolina	$1,675	$303	$1,400	$265

a New Jersey and North Carolina costs in all four columns are statistically significantly different at the $p<.001$ level.

An unlikely reason for this difference is that suggested by the ICD code analysis -- that New Jersey physicians are treating more complicated cases. Although this reason can probably safely be discarded, a number of other possibilities are fairly compelling, such as the rural/urban split. On average, rural hospitals tend not to support the expensive, tertiary care technologies and specialists offered by urban referral centers. The lesser costs of North Carolina may be a reflection of the larger numbers of patients admitted to rural hospitals (see Table 8.4). For DRG 294 for example, 55% of North Carolina patients are admitted to rural hospitals whereas only 6% of New Jersey patients enter rural facilities.

Other reasons for the interstate Part B difference result from possible differences in practice styles -- lengths of stay, specialists as attending physician, and use of consultants. Figure 8.2 explores this first issue of length of stay. Length of stay is substantially longer in New Jersey than in North Carolina: by 2.73 days in DRG 294 and by 3.44 days in DRG 295. Figure 8.2 also demonstrates that this difference is not affected by the different proportions of patients in rural versus urban hospitals in the two

TABLE 8.4

NUMBER (PERCENT) OF DIABETES MELLITUS CASES

IN URBAN AND RURAL HOSPITALS

	DRG 294		DRG 295	
State	Urban	Rural	Urban	Rural
New Jersey	4,142 (94%)	261 (6%)	143 (97%)	5 (3%)
North Carolina	2,065 (45%)	2,570 (55%)	37 (47%)	42 (53%)

states. In both states, the rural and urban hospitals have virtually identical lengths of stay. Therefore, differences in length of stay reflect statewide practice patterns.

New Jersey patients are more likely to have a specialist as the attending physician (see Table 8.5). For example, in DRG 294 general and family practitioners follow only 22.4% of the cases in New Jersey whereas in North Carolina the figure is 41.8%. Since specialists generally receive higher fees, a portion of the cost differential could be attributed to this practice style.

Finally, New Jersey patients also receive more specialist consultations than North Carolina patients (see Figure 8.3). In both medical and surgical areas two to three times more New Jersey patients overall obtain consultations. The urban/rural consultation differential is not always predictable. Concentrating only on the more important DRG 294, medical consultation rates were greater in urban than rural New Jersey, but not by much (28.8% versus 22.2%). However, the opposite is true for surgical consultations -- 21.2% for urban patients and 26.1% for rural patients. In North Carolina, 18.6% of urban patients and 6.8% of rural patients received

Figure 8.2
Length of Stay with Urban/Rural Splits:
DIABETES DRGs

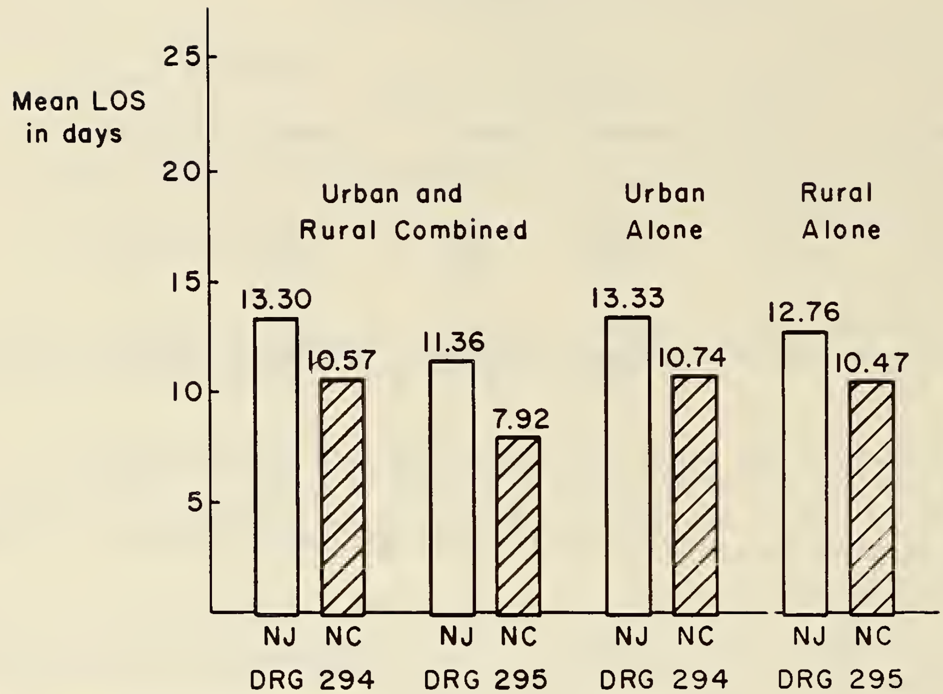

Figure 8.3
Percent of Patients Receiving
Medical and Surgical Consultations
DIABETES DRGs

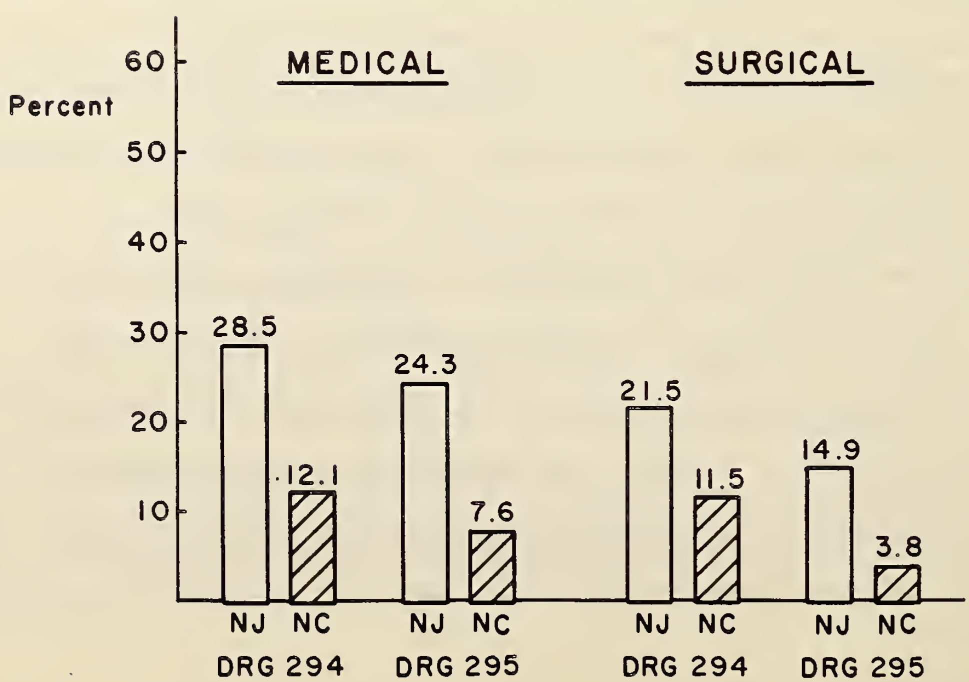

TABLE 8.5

SPECIALTIES OF ATTENDING PHYSICIANS

(PERCENT OF CASES)

Specialty	DRG 294[a] New Jersey (N=4403)	DRG 294[a] North Carolina (N=4635)	DRG 295[b] New Jersey (N=148)	DRG 295[b] North Carolina (N=79)
General/Family Practice	22.4	41.8	13.5	35.4
Internal Medicine	59.6	48.2	74.3	55.7
Cardiology	5.1	1.2	2.0	5.1
Other	12.9	8.8	10.2	3.8
	100.0	100.0	100.0	100.0

a Chi-square comparison of New Jersey and North Carolina data yielded x^2=433.7, p<.001.

b Numbers of cases were too small to perform a reliable chi-square comparison.

medical consultations. Similarly, 14.0% of urban patients and 9.4% of rural patients obtained surgical consultations. Consistently throughout these comparisons New Jersey rates are higher than North Carolina rates. This factor may further contribute to greater Part B costs in New Jersey than North Carolina.

In summary, different New Jersey and North Carolina costs may be partially due to discrepant practice styles in the two states. These geographic variations are striking and may need to be considered in design of a physician reimbursement system.

8.6.2 Splitting the Diabetes Mellitus DRGs

The diabetes mellitus DRGs group together all diabetics regardless of acute or chronic complications. The DRGs also display very heterogeneous costs (see Table 8.6). In an attempt to create more homogeneous groups, DRG 294 was split as follows:

> The analysis focused on DRG 294 because it had the larger caseload. Part B costs were compared at the individual ICD code level. In most cases, ICD code costs were consistent with clinical expectations. For example, cases in the hyperosmolar coma code displayed much higher average costs than cases in the uncomplicated diabetes codes. Four different attempts were tried to split the DRG into more homogeneous cost categories. Splits were made both along clinical and cost lines. The Part B cost data were then grouped into these new categories. Means and CVs were computed; t-tests were performed to assess the differences of the new means. Results appear in Table 8.7.
>
> The results of splitting DRG 294 are summarized below:
>
> 1. Splits #2, #3 and #4 created groups with signficantly different mean costs. In some cases, the differences were dramatic. For example, in New Jersey in Splits #2 and #3, Group A average costs were twice that of Group B average costs.
>
> 2. In Splits #2, #3, and #4, the more costly groups had the higher CV. A plausible clinical explanation is that these more costly groups also probably contain more cost outliers.

Thus, these splits succeed in one sense (they create groups with very different costs; these groups may be a fairer basis for a reimbursement system) but they fail in another (they do not create homogeneous cost groups). Why this second failure?

TABLE 8.6

COEFFICIENTS OF VARIANCE IN DIABETES MELLITUS DRG COSTS

	DRG 294		DRG 295	
State	Part A	Part B	Part A	Part B
New Jersey	1.0180	0.8770	0.9650	0.7680
North Carolina	1.0890	0.9250	1.0540	0.9390

TABLE 8.7

RESULTS OF SPLITTING DRG 294

Description of Splits	NUMBER OF CASES		MEAN PART B COST		CV		T-TEST ON MEANS[a]	
	New Jersey	North Carolina	New Jersey	North Carolina	New Jersey	North Carolina	New Jersey	North Carolina
Split #1								
Group A: Cases listed as either adult onset or unspecified onset (ICD code fifth digit = 0)	2,846	4,514	$523	$302	0.7882	0.9309	t=1.70 N.S. -4, 62	t=1.88 N.S. -2, 88
Group B: Cases listed as juvenile onset (ICD code fifth digit = 1)	1,557	121	$552	$345	1.007	0.7304		
Split #2								
Group A: DKA, coma, renal complications	418	144	$843	$464	1.2348	1.1654	t=3.97 p<.001 221, 653	t=2.54 p<.02 44, 340
Group B: All others	3,985	4,491	$406	$272	0.7852	0.9066		
Split #3								
Group A: DKA, coma, renal complications, peripheral vascular disease	584	183	$793	$452	1.1495	1.0647	t=5.42 p<.001 332, 474	t=3.76 p<.001 87, 277
Group B: All others	3,819	4,452	$390	$270	0.7662	0.9057		

a Includes minimum and maximum values of 95% confidence interval around difference in mean values for Groups A and B.

TABLE 8.7 CONTINUED

Description of Splits	NUMBER OF CASES		MEAN PART B COST		CV		T-TEST ON MEANS[a]	
	New Jersey	North Carolina	New Jersey	North Carolina	New Jersey	North Carolina	New Jersey	North Carolina
Split #4								
Group A: Cases listed as uncomplicated or with "elsewhere classified" and unspecified complications	3,631	4,397	$384	$269	0.7710	0.9080	t=7.43 p<.001 250, 428	t=4.55 p<.001 86, 216
Group B: Cases in which complications were specified	772	238	$723	$420	1.0377	0.9969		

a Includes minimum and maximum values of 95% confidence interval around difference in mean values for Groups A and B.

Partial blame for this failure can probably be placed at the ICD code level. The splits were made along ICD code lines. However, the ICD codes themselves fail to adequately group homogeneous cost categories (see Figure 8.4). The ICD codes also fail to explain much of the variation within the DRGs (Tables 8.8 and 8.9). But the clinical discussion emphasized that these DRGs group together multiple clinical entities or presentations of diabetes mellitus. Certainly this clinical heterogeneity must account for a portion of the cost variability. The low R^2 thus may suggest that the ICD codes alone may not adequately capture the clinical heterogeneity.

This splitting exercise has thus yielded several findings which may have relevance for physician reimbursement. The most important is that breaking down DRG 294 along clinical lines yields groups with very different average costs -- in some cases, the average cost of one group is twice that of the other. Unfortunately, cost homogeneity did not significantly improve with this splitting process. However, to the extent that the reimbursement system continues to tolerate high cost variability, these new splits may form a more equitable basis for physician reimbursement.

8.7 IMPLICATIONS OF PROSPECTIVE REIMBURSEMENT FOR PHYSICIAN BEHAVIOR

Two issues dominate in this analysis of diabetes: (1) the merged problem of multiple clinical entities and widely varying severities; and (2) the differences in management philosophies adopted by physicians and diabetic patients. These issues suggest two major sets of implications of the PPS for the behavior of physicians treating diabetics.

First, as the clinical discussion showed, the occurrence of severe complications is not necessarily a random clinical event. A very predictable group of patients will suffer these setbacks. For example, a "brittle diabetic" with highly labile blood glucose is prone to DKA; a long-term Type I

Figure 8.4
New Jersey Part B Costs of Selected ICD Codes: DRG 294

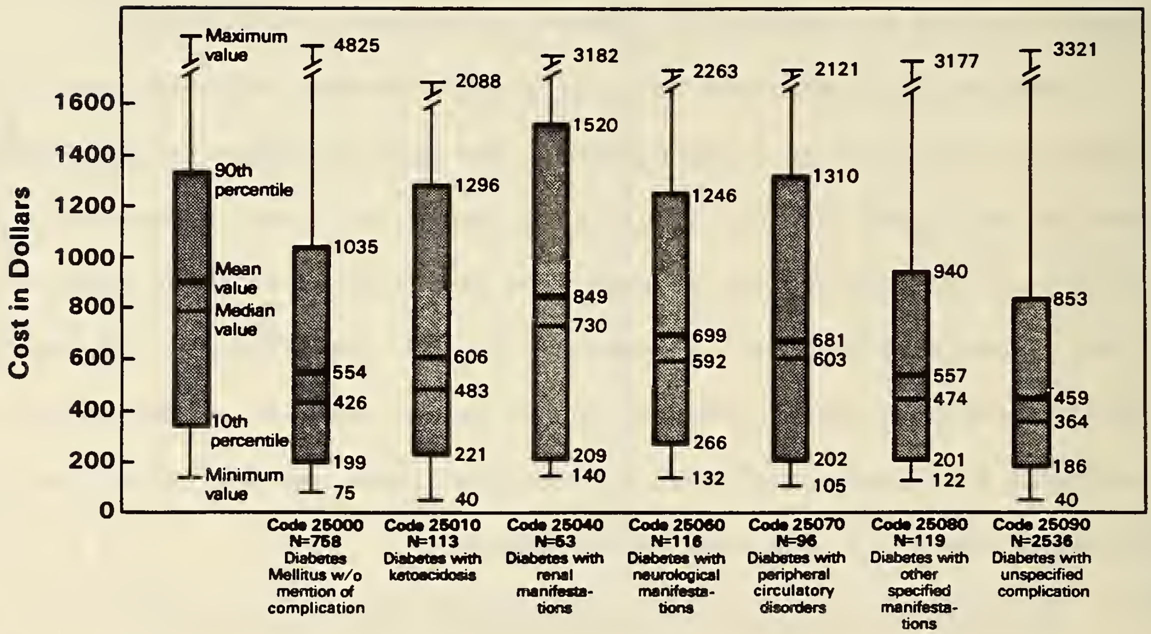

TABLE 8.8

R^2: REDUCTION IN VARIABILITY WHEN DRGS ARE SPLIT INTO ICD CODES

	DEPENDENT VARIABLE					
	Part A Costs		Part B Costs		Length of Stay	
DRG	New Jersey	North Carolina	New Jersey	North Carolina	New Jersey	North Carolina
294	0.046[a]	0.025[a]	0.050[a]	0.021[a]	0.010[b]	0.015[a]
295[c]	0.252[b]	0.154[d]	0.086	0.022	0.092	0.027

a Significant at $p<.001$.

b Significant at $p<.01$.

c Numbers in DRG 295 are very small, particularly in each ICD grouping. Groups with only one case were excluded from the calculations.

d Significant at $p<.05$.

TABLE 8.9

R^2: REDUCTION IN VARIABILITY WHEN DRGS ARE SPLIT INTO ICD CODES WITH NEC AND NOS CODES REMOVED

	DEPENDENT VARIABLE					
	Part A Costs		Part B Costs		Length of Stay	
DRG	New Jersey	North Carolina	New Jersey	North Carolina	New Jersey	North Carolina
294	0.039[a]	0.025[a]	0.035[a]	0.018[a]	0.012	0.015[a]
295[b]	0.385[c]	0.162[c]	0.138	0.022	0.148	0.029

a Significant at $p<.001$.

b Numbers in DRG 295 are very small, particularly in each ICD grouping. Groups with only one case were excluded from the calculations.

c Significant at $p<.05$.

diabetic almost inevitably develops retinopathy and nephropathy. These identifiable groups of patients are very costly to treat and may need a host of specialized services. Depending upon the community resources, a general medical doctor may choose to refer patients in these particularly worrisome groups to diabetes specialists. The specialist will then, in effect, serve as the primary care provider for the diabetic patient. This is already done in many communities and may in fact represent an efficiency in care delivery (diabetologists may include in their practice dieticians, nurse-teachers, podiatrists, referral ophthalmologists). The prototype of such a specialized care setting is the Joslin Diabetes Center in Boston which routinely electively admits patients from around the world for assessment of blood sugar control, evaluation of chronic complications, and diabetic teaching.

A PPS may further encourage such referrals. General medical doctors may prefer to avoid the intense level of effort required in treating patients with multiple long-term complications who may need prolonged hospitalizations. Quality of care may be improved: an experienced diabetologist best understands the myriad needs of the diabetic and may be uniquely able to mobilize the resources required to meet those needs. However, a set DRG fee places the diabetologist at relatively higher financial risk. His patients are systematically sicker than those of the general medical doctor. They may require more consultations and diagnostic and therapeutic interventions. Diabetologists may be more likely to "lose" under a prospective payment system.

Second, a wide range of treatment styles may be practiced by physicians and patients in managing this chronic illness. There is considerable room for manipulation of setting of care. For example, if tight blood glucose control is advocated, a patient may be intensively tutored as an inpatient in techniques of home glucose monitoring. Even if moderate control is the goal, the newly-diagnosed diabetic may find it most convenient to learn about insulin and injections in a hospital where a nurse is always available to help. However, with a modicum of extra effort, both these aims may be suitably achieved in an outpatient setting in many cases.

It is difficult to assess the extent and costs of the admission for diabetic teaching. As mentioned earlier, almost 80% of North Carolina patients and 20% of New Jersey patients are classified as ICD Code 25000: Diabetes without mention of complication. The use of the work "mention" in the definition of this code may be of major importance in conjectures about the nature of these patients; probably a substantial number of these patients actually do have a complication but it was not mentioned in the discharge abstract from which the code was drawn. But possibly a subset of this group actually do not have complications of diabetes mellitus. Why were they admitted to the hospital? These are probably the newly-diagnosed diabetics with education as the major goal of hospitalization.

The financial incentives of the PPS would perhaps encourage admission for teaching. The physician would receive his lump fee for a relatively small investment of time. The majority of the educational efforts would probably be mounted by the nursing staff, and thus covered under the Part A payment. There may be cases in which it is medically legitimate to admit the newly-diagnosed diabetic (e.g., a patient with labile sugars who may need multiple injections or an elderly patient who has an inadequate understanding of the immediate dangers of his illness). But in other cases, such admissions are clearly unwarranted. Only a case-by-case review (by a PRO, for example) could accurately establish appropriateness. Thus, this costly practice may continue unmonitored.

A number of other possible implications may have lesser impact. Splitting admissions may be feasible in particular instances: for example, a patient admitted for evaluation of peripheral vascular disease is found to have a dry, dead toe; he may be readmitted electively for amputation. Consultations, particularly by ophthalmologists, may be obtained as an outpatient. Finally, to the extent possible, DRG creep may take place. Diabetes DRGs have relatively low relative weights compared to other DRGs which approximate a diabetic complication, as follows:[97]

DRG 294	Diabetes Age >36	R.W. 0.8087
DRG 295	Diabetes 0-35	R.W. 0.7457
DRG 316	Renal Failure without dialysis	R.W. 1.3314
DRG 130	Peripheral Vascular Disease Age >69 and/or c.c.	R.W. 0.9645
DRG 131	Peripheral Vascular Disorders Age <70 without c.c.	R.W. 0.9491
DRG 132	Atherosclerosis Age >69 and/or c.c.	R.W. 0.9182
DRG 133	Atherosclerosis Age <70 without c.c.	R.W. 0.8599
DRG 277	Cellulitis Age >69 and/or c.c.	R.W. 0.8863
DRG 278	Cellulitis Age 18-69 without c.c.	R.W. 0.8096

It may be possible to introduce some flexibility into the coding of the principal diagnosis which would allow a higher reimbursement level. Although the ICD list of diabetic complications is fairly broad (i.e., DKA, hyperosmolar coma, renal/ophthalmic/neurologic manifestations, peripheral circulatory disorders), it does not include all complications (.e.g, skin infections, accelerated atherosclerosis, visceral neuropathy).

8.8 SUMMARY AND CONCLUSIONS

Millions of Americans are afflicted by diabetes mellitus. Although many of these persons are able to live quite well without hospitalization, there are certain specific classes of patients for whom the fairly predictable complications of the illness generate expensive hospital stays. Diabetes mellitus is not a homogeneous pathophysiologic process let alone clinical

97 "Rules and Regulations," Federal Register 48 (September 1, 1983): 39876-39886. All diabetes ICD codes are considered legitimate comorbidities.

entity. From the former standpoint, it is partitioned into two disorders, Type I and Type II, based upon insulin dependence. From the latter perspective, it can present as a number of clinical entities, including blindness, renal failure, sensory loss, coma, shock, and death. Within each clinical entity, there may be a range of severities: for example, a patient may be in a preliminary stage of DKA and fairly alert or may be in coma. Between the clinical entities, it may sometimes be possible to assign a severity rank. For example, coma is clearly a more severe condition than a gangrenous toe. But determining relative severities between clinical entities may not always be clear-cut. DRGs 294 and 295 group together these many entities. The age cut-off, however, probably partitions diabetics fairly completely -- DRG 294 for Type II and DRG 295 for Type I.

The CVs in these DRGs are high, particularly in DRG 294. Part A CVs are 1.0180 in New Jersey and 1.0890 in North Carolina; Part B CVs are 0.8770 in New Jersey and 0.9400 in North Carolina. To improve performance of these DRGs, the state data analysis contains an exercise involving splitting these DRGs along clinical and Part B cost lines. At the individual ICD code level, magnitude of cost was generally consistent with clinical expectations. Three of the four attempted splits produced groups with significantly different mean costs. However, cost variability remains high within subgroups. Despite this, these splits may form the basis of a more equitable physician reimbursement scheme. The state data section also highlighted the striking regional variation in practice patterns.

Because of the magnitude of the definitional and severity problems, it is difficult to separate hospital and physician issues in these DRGs. However, because of their smaller caseloads, particular physicians may be more vulnerable under a single DRG payment system. Diabetologists, for example, are likely to serve as the primary care physician for patients whose blood sugars are more difficult to control or who suffer the sequelae of the disease. These are predictably more expensive patients. Physicians who believe that tight blood glucose control lessens the microvascular complications of the disease are also likely to incur higher costs in caring for their patients.

An important physician incentive under the PPS may be to transfer care for those classes of predictably expensive patients from generalists to specialists or even specialized diabetes centers (e.g., Joslin Diabetes Center, university-affiliated diabetes clinics). Hospitals presumably do not have the same luxury (there are very few inpatient centers specifically for diabetics). Otherwise, physicians and hospitals may share certain incentives, as follows:

1. Teaching Admissions. Hospitals have an incentive to allow admissions (of limited lengths) exclusively for diabetic teaching. The major costs of these admissions would be nursing care; no expensive diagnostic or therapeutic technologies are required. Physicians have the same incentive.

2. Initial Work-Up Setting. Hospitals have an incentive to encourage brief initial work-up admissions, because diagnostic evaluation in diabetes is so relatively cheap. Physicians would have the same incentive.

3. Subsequent Work-Up Setting. Hospitals have an incentive to move technologically intensive work-up of long-term complications from an inpatient to an outpatient setting. Physicians would have the same incentive, both for testing and consultations.

4. Case Mix. Hospitals have an incentive to admit patients with marginal indications. Physicians would have the same incentive.

5. Split Admissions. Hospitals have an incentive to split medical and surgical admissions. Physicians would have the same incentive.

6. DRG Creep. To the extent that there is flexibility in coding diabetic complications, hospitals have an incentive to move patients into the most profitable DRG. Physicians would have the same incentive.

Finally, diabetes mellitus is a serious disease uniquely influenced by patient attitudes and actions. For example, one patient may be highly motivated for tight control and learns quickly during a teaching admission. Another patient may subvert therapeutic goals by eating the cookies brought to the hospital by his family or by refusing to consume his 10:00 p.m. snack. The relationship between many diabetic patients and their physicians may become a partnership. The direction of care becomes very much a joint venture, with the patient sharing in many if not all major decisions. Yet under the PPS, only the physician would be subject to the financial risks. How would this alter the physician-patient relationship?

Chapter 9

RED BLOOD CELL DISORDERS: MEDICAL DRGS

DRG 395: Red Blood Cell Disorders Age $\geq$ 18

DRG 396: Red Blood Cell Disorders Age 0-17

9.1 INTRODUCTION

Even under the most powerful microscope, mature red blood cells have a remarkably bland appearance. However, this unassuming exterior masks their complexity. The more complex the cell, the more that can go wrong, and there are multiple junctures in a red blood cell's life where mishaps may occur. DRGs 395 and 396 lump together these happenings under the broad rubric, red blood cell disorders. Some of these disorders exact a severe human toll. For example, sufferers of certain hemoglobin diseases (generically termed "hemoglobinopathies") die early in childhood. Others, although not life-threatening, are extremely common. For example, iron deficiency anemia strikes one-fifth of women of child-bearing age. For whatever reason -- either because they are common or costly -- one would expect red blood cell disorders to yield a significant financial burden for the system overall.

Although most red blood cell disorders are ambulatory conditions, they also appear to provide substantial inpatient caseloads. The 1982 Medicare data groups 2,782 New Jersey patients and 2,367 North Carolina patients into the two red blood cell DRGs. The costs are also high. Combined Part A and B costs for New Jersey were $7,668,665; costs in North Carolina were $4,723,893. Given these costs, the extent of cost variation within the DRGs is also important; the CVs are very high. In New Jersey the DRG 395 Part A CV is 0.9890, and the Part B CV is 0.9320. In North Carolina the DRG 395 Part A CV is 1.0710, and the Part B CV is 0.9390. Can the clinical perspective suggest possible roots of these large CVs? The answer lies mainly along three dimensions:

1. Each of the DRGs contains a variety of clinical entities with potential impact on a variety of different organ systems;

2. Each unique clinical entity can present with widely varying degrees of severity; and

3. Each clinical entity requires specific diagnostic and therapeutic interventions; additional requirements are dictated by the range of other organ involvement.

The ensuing chapter examines these clinical issues.

9.2 DEFINITIONAL PRECISION

Broadly speaking, the red blood cell disorder DRGs deal with "anemias." However, anemia is a symptom, not a diagnosis. It must be caused by something. Anemia occurs when the oxygen reaching the tissues is inadequate. Patients may look pale and feel tired or light-headed; in its most severe form, congestive heart failure and shock may ensue. DRGs 395 and 396 contain the same 41 ICD codes (see Table 9.1) which represent diseases causing anemia. Even though these 41 diagnoses result in the same symptom -- anemia -- the diseases themselves are quite different and require different treatments.

From scanning the codes contained in Table 9.1, one would expect that definitional imprecision presents a significant clinical problem for DRGs 395 and 396. The diagnostic data for New Jersey and North Carolina are surprising (see Figure 9.1). Not only are multiple types of diagnoses being treated, but also the two states are not treating the same diagnoses. The state data for DRG 395 raise the following concerns:[98]

1. The top five diagnoses represent many very different disorders. Iron-deficiency anemia differs from a sickle cell crisis (Hemoglobin-S disease) which differs from aplastic anemia.

2. New Jersey and North Carolina are treating different diseases. The most common North Carolina diagnosis (Code 28500, sideroblastic

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98 DRG 395 (red blood cell disorders in adults) is the only one of the two for which significant volumes and comparison data exist.

TABLE 9.1

ICD-9-CM CODES CONTAINED IN DRGS 395 AND 396

DRG 395, MDC 16M, RED BLOOD CELL DISORDER AGE $\geq$ 18

PRINCIPAL DIAGNOSIS

28000	Chr Blood Loss Anemia	28269	Sickle-Cell Anemia NEC
28010	Iron Def Anemia Dietary	28270	Hemoglobinopathies NEC
28080	Iron Defic Anemia NEC	28280	Hered Hemolytic Anem NEC
28090	Iron Defic Anemia NOS	28290	Hered Hemolytic Anem NOS
28100	Pernicious Anemia	28300	Autoimmune Hemolytic Anem
28110	B12 Defic Anemia NEC	28310	Nonautoimmune Hemolyt Anem
28120	Folate-Deficiency Anemia	28320	Hemolytic Hemoglobinuria
28130	Megaloblastic Anemia NEC	28390	Acq Hemolytic Anemia NOS
28140	Protein Defic Anemia	28400	Congen Aplastic Anemia
28180	Nutritional Anemia NEC	28480	Aplastic Anemias NEC
28190	Deficiency Anemia NOS	28490	Aplastic Anemia NOS
28200	Hereditary Spherocytosis	28500	Sideroblastic Anemia
28210	Heredit Elliptocytosis	28510	Ac Posthemorrhag Anemia
28220	Glutathione Dis Anemia	28580	Anemia NEC
28230	Enzyme Defic Anemia NEC	28590	Anemia NOS
28240	Thalassemias	28970	Methemoglobinemia
28250	Sickle-Cell Trait	79000	Abnormal Red Blood Cell
28260	Sickle-Cell Anemia NOS	99960	ABO Incompatibility React
28261	Hb-S Disease w/o Crisis	99970	Rh Incompatibility React
28262	Hb-S Disease with Crisis	99980	Transfusion Reaction NEC
28263	Sickle-Cell/Hb-C Disease		

DRG 396, MDC 16M, RED BLOOD CELL DISORDER AGE 0-17

PRINCIPAL DIAGNOSIS

28000	Chr Blood Loss Anemia	28269	Sickle-Cell Anemia NEC
28010	Iron Def Anemia Dietary	28270	Hemoglobinopathies NEC
28080	Iron Defic Anemia NEC	28280	Hered Hemolytic Anem NEC
28090	Iron Defic Anemia NOS	28290	Hered Hemolytic Anem NOS
28100	Pernicious Anemia	28300	Autoimmune Hemolytic Anem
28110	B12 Defic Anemia NEC	28310	Nonautoimmune Hemolyt Anem
28120	Folate-Deficiency Anemia	28320	Hemolytic Hemoglobinuria
28130	Megaloblastic Anemia NEC	28390	Acq Hemolytic Anemia NOS
28140	Protein Defic Anemia	28400	Congen Aplastic Anemia
28180	Nutritional Anemia NEC	28480	Aplastic Anemias NEC
28190	Deficiency Anemia NOS	28490	Aplastic Anemia NOS
28200	Hereditary Spherocytosis	28500	Sideroblastic Anemia
28210	Heredit Elliptocytosis	28510	Ac Posthemorrhag Anemia
28220	Glutathione Dis Anemia	28580	Anemia NEC
28230	Enzyme Defic Anemia NEC	28590	Anemia NOS
28240	Thalassemias	28970	Methemoglobinemia
28250	Sickle-Cell Trait	79000	Abnormal Red Blood Cell
28260	Sickle-Cell Anemia NOS	99960	ABO Incompatibility React
28261	Hb-S Disease w/o Crisis	99970	Rh Incompatibility React
28262	Hb-S Disease with Crisis	99980	Transfusion Reaction NEC
28263	Sickle-Cell/Hb-C Disease		

Figure 9.1A
Five Most Common ICD Diagnoses
in DRG 395

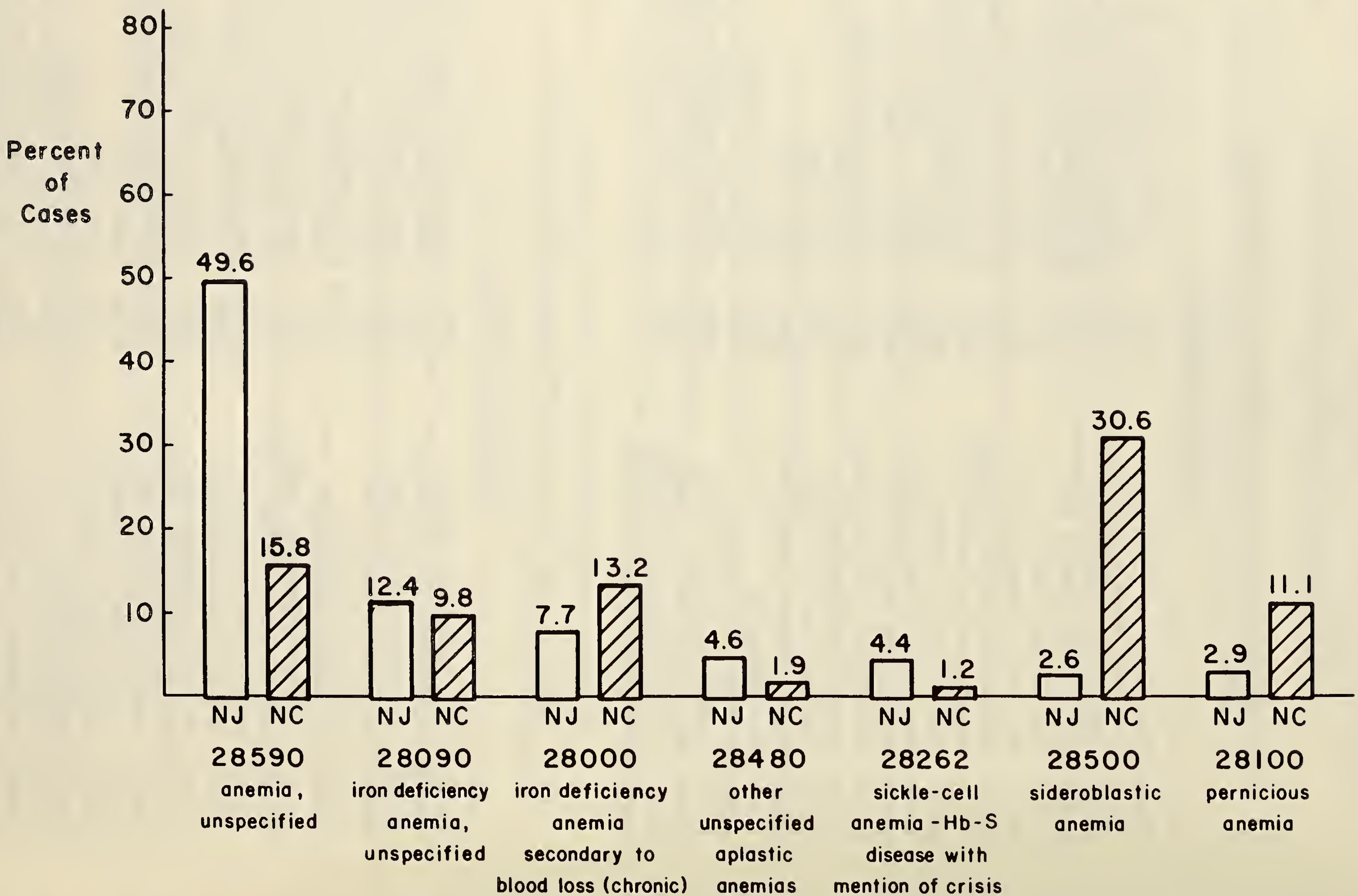
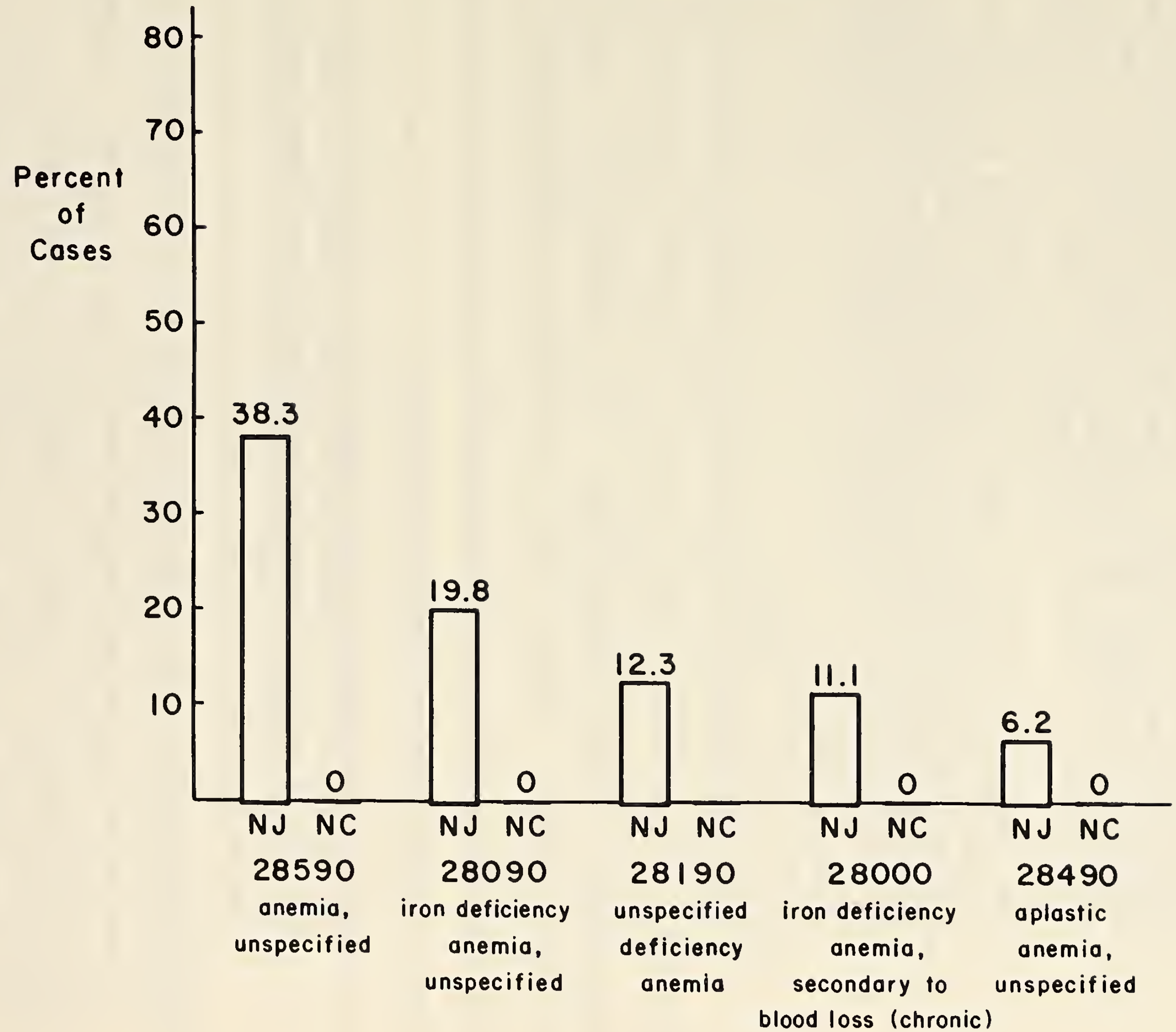


Figure 9.1B[a]
Five Most Common ICD Diagnoses
in DRG 396



[a] No North Carolina cases were assigned to DRG 396.

anemia) does not even appear on the New Jersey list of the top five.[99] North Carolina patients with pernicious anemia (Code 28100) form 11.1% of that state's caseload; this code is also not listed in New Jersey's top five. New Jersey, however, includes two extremely costly and life-threatening disorders which are not ranked in North Carolina: aplastic anemia (Code 28480) and sickle cell crisis (Code 28262).

3. The top five diagnoses account for approximately four-fifths of the patients in the two states. In New Jersey the additional 20% used 29 other ICD diagnoses allowed by the DRG; in North Carolina this group used 26. Altogether, out of the 41 possible ICD codes, New Jersey patients used 34, and North Carolina patients used 31. Thus, patients in this DRG were not limited to a few, similar diagnoses.

4. The quality of the data in the two states appears to differ. Half of the New Jersey patients (49.6%) were coded by the catch-all designation, Code 28590 Anemia, unspecified: excludes blood loss, iron deficiency. Even with these two exclusions, these New Jersey patients could have a wide variety of disorders. In North Carolina, only 15.8% of patients received this code. The most populous North Carolina code (30.6% of patients) was the very specific Code 28500, sideroblastic anemia.

Definitional imprecision thus appears to be the major clinical flaw of these DRGs. It therefore becomes important to emphasize the diversity of those clinical entities causing anemia. Since the red cell is the sole means of oxygen transport, the term anemia is synonymous to some compromise of the oxygen-carrying capacity of the red blood cell. Three types of events may account for this impaired capacity as follows:

1. Decreased Production of Red Blood Cells. Causes range from inadequate diet to persistent diarrheal illnesses to chronic diseases (e.g., tuberculosis, renal failure, malignancy, rheumatoid arthritis) to gastric atrophy to parasitic infestations to the emergency of bone marrow failure.

99 This high prevalence of sideroblastic anemia is very surprising; it is generally diagnosed only after a specific cell type ("ringed sideroblasts") are spotted on microscopic examination of the bone marrow. One reason for the unexpected frequency of this code may be poor attention to coding detail by North Carolina coders. Codes 2850 and 28500 designate sideroblastic anemia. Code 285 is a broad title heading a section called "Other and Unspecified Anemias." Instead of listing the required four and five digit codes, North Carolina coders may be merely recording three digits, 285. The extra zeroes are added by the computer, so the impact of this coding practice is impossible to assess. Another possibility arises from the association of sideroblastic anemia with alcohol abuse. It is possible that anemic alcoholics routinely receive this diagnosis.

2. Increased Destruction of Red Blood Cells in the Body. Causes range from transfusion reactions to idiosyncratic autoimmune responses to artificial heart valves to abnormally fragile red blood cell membranes to abnormal enzymes and hemoglobin.

3. Outright Loss of Blood. Causes range from trauma to peptic ulcer disease to rupture of an aortic aneurysm to a tumor eroding into a major vessel.

To further explore these multiple entities and their various presentations and complications, a detailed clinical discussion is appended to the end of this chapter (see Section 9.9, Clinical Appendix).

In summary, the major definitional concerns are as follows:

1. The disorders included in DRGs 395 and 396 represent very different disease processes. These different diseases demand specific diagnostic and therapeutic approaches, and thus different resource investments.

2. Many of these disorders are actually caused by failure in another organ system. Several examples are the severe anemia of chronic renal disease, the slow blood loss anemia of gastrointestinal malignancy, and the sideroblastic anemia of chronic alcoholism.

3. Many of these disorders actually cause failure in another organ system. Several examples are the nervous system damage of pernicious anemia, the shock of a severe transfusion reaction, and the chronic multiorgan decompensation of sickle cell anemia.

These last two issues preview a concern which must be addressed in incorporating these DRGs into the reimbursement system. Choice of the principal diagnosis for patients with anemia may well be dictated by the other organ systems involved and by the relative size of DRG payment for diseases of those organ systems. For example, a physician may be better paid if he classified his sickle cell anemia patient with a stroke as a cerebrovascular disease patient (relative weight of DRG 395 is 0.7839, whereas for cerebrovascular disease DRG 14 the weight is 1.3527[100]). Similarly, he may be better paid if he classified his chronic diarrhea patient with a deficiency

100 "Rules and Regulations," Federal Register 48 (September 1, 1983): 39876-39886. These examples use current hospital weights for illustrative purposes only.

anemia as a red blood cell disorder patient (relative weight of chronic diarrhea DRG 183 is 0.5652). This issue will be discussed in detail in Section 9.7.

9.3 SEVERITY OF ILLNESS

Given the diversity of the incorporated diseases, it is difficult to generalize about severity of illness in DRGs 395 and 396. Severity among the different disorders is just as important as severity within each disorder. If one were to map severity of illness for patients in these DRGs, certain ICD codes would cluster on the continuum -- aplastic anemia is generally a serious disease whereas iron deficiency anemia is generally fairly mild. But once all 41 ICD codes were plotted, a broad range of severities would be represented.

Therefore, severity across diseases is a major problem for these DRGs. Many of these diagnoses would be difficult to justify as the principal reason for hospitalization. These diseases can be well-treated on an outpatient basis. For example, an otherwise healthy patient with iron deficiency anemia and without evidence of bleeding can easily be given iron supplements as an outpatient. This is true of most of the deficiency anemias (B12, folic acid). Both initial work-up and treatment can be handled outside the hospital. One diagnosis which should seldom dictate hospitalization is sickle cell trait, Code 28250. Persons with only one sickle cell gene are rarely symptomatic.

Exceptions to the approach outlined above may be reasonable for the frail elderly. These are patients who may have an anemia of equal severity as a younger patient, but because of the frailties of advanced age are less able to tolerate outpatient work-ups. For example, a middle-aged patient may have an iron deficiency anemia and evidence of a trace of bleeding from his gastrointestinal tract. Work-up for malignancy could proceed outside the hospital. A patient over 80 with the identical situation is most safely evaluated as an inpatient.

On the other hand, patients with certain diagnoses are by definition severely ill, require hospitalization, and often life-saving therapy. Patients with ABO or Rh incompatibility reactions (Codes 99960, 99970), with acute posthemorrhagic anemia (Code 28510), or patients with a massive hemolytic anemia require immediate attention. These patients may stabilize relatively quickly. But within the first critical time period, they may consume large quantities of resources. Other patients are also medical emergencies but may take long periods to treat. Two examples are severe aplastic anemia and transfusion-dependent thalassemia. These patients may be hospitalized for months and consume massive amounts of resources. Unfortunately, the outcome of these hospitalizations is often poor; these disorders have bleak prognoses.

A subset of the hemolytic anemias is unique in that, although the disorder may be severe, it may be cured by surgical removal of the spleen.[101] Hereditary spherocytosis (Code 28200), hereditary elliptocytosis (Code 28210), and autoimmune hemolytic anemia (Code 28300) are examples of such diseases. Splenectomy is major abdominal surgery and as such is quite costly. Absence of the spleen also exposes the patient to increased risk of infections throughout the remainder of his life. However, because of its success, it is often performed for these patients, transforming a serious ailment into a relatively benign condition.

Therefore, severity of illness is a complex issue for the red blood cell disorder DRGs. Given the definitional imprecision of these DRGs, it is inevitable that they should encompass patients of widely divergent severities. Some of the patients with the most serious diseases may inevitably become outliers (because of the prolonged nature of their therapy); others may absorb

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101 A splenectomy would transfer a patient to the surgical DRG 392; the relative weight of DRG 392 is 2.7746.

large resources in limited periods of time. These issues have implications for both Parts A and B, and must be considered in design of the reimbursement system.

9.4 DISCRETIONARY USE OF RESOURCES

The range of diagnostic approaches is not as broad for red blood cell disorders as for many other diseases. The options are also not as expensive as those for other illnesses. Many of the 41 ICD diagnoses could be made simply on the basis of a few, inexpensive laboratory tests. However, the issue becomes complicated by the scope of other organ involvement. If consideration of diagnostic approaches is widened to include interaction with other organ systems, innumerable possibilities arise. Because of these multiple presentations, it is not feasible here to pursue an exhaustive presentation of the various resource options. The following discussion will therefore be limited to a topic particularly germane to an elderly population -- work-up of chronic blood loss anemia. However, the first paragraphs focus on general topics in assessment of red blood cell disorders.

Most patients who are ultimately diagnosed as having a red blood cell disorder probably present to their primary care physicians with very non-specific complaints. They may feel tired, unusually irritable, or faint; they may complain of trouble concentrating or sleeping. Another common presentation is the incidental finding of anemia on a routine blood test. Only patients who are aware of a heritable disorder (e.g., sickle cell anemia, hereditary spherocytosis) might choose to contact a specialist for initial investigation. Most general medical doctors are accustomed to the work-up and treatment of uncomplicated deficiency anemias: for example, iron-deficiency anemias are exceedingly common. Even if a specialist is required for diagnostic testing (e.g., bone marrow examination), once the diagnosis is made, treatment for many disorders can be easily handled by a general medical doctor. However, these are generally ambulatory conditions. If a patient is ill enough to require hospitalization, consultation with a specialist may be desirable.

Two major types of specialists see patients with red blood cell disorders: hematologists and blood bank specialists (blood banking is a sub-specialty of pathology). Hematologists are trained in the diseases of blood and bone marrow; because of their experience they can often suggest diagnoses merely by studying the morphology of cells on the blood smear. Hematology is an area in which there are few expensive diagnostic technologies. Cognitive skills are of greatest importance: diagnoses are based upon thoughtful interpretation of relatively few test results. Hematologists are trained to do just this. If a patient will require multiple transfusions, a blood bank specialist must be consulted.[102] The risk of a transfusion reaction increases proportionately to the number of transfusions. Blood bankers are in the best position to recommend special blood products and procedures to minimize the risk of these reactions.

A patient hospitalized with a red blood cell disorder may well have major difficulties with other organ systems. Appropriate consultations must be individualized to a patient's needs. The most obvious example is a patient with anemia caused by an underlying disease. That disease must be adequately treated before the anemia will resolve. Another example is the patient admitted for complications of sickle cell disease. Such patients may ultimately require consultations with ophthalmologists, neurologists, infectious disease specialists, nephrologists, pulmonologists, dermatologists, and others.

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102 Blood bank specialists may be salaried hospital physicians. A separate fee would therefore not be charged for the consultation.

Hematology is an area where diagnostic testing is relatively inexpensive. In many cases, diagnosis can be made from a single blood drawing. The only relatively expensive diagnostic test pertaining specifically to the red blood cell disorder (not effects on other organ systems) is the bone marrow exam. This exam is usually obtained only if the blood studies are inconclusive. A bone marrow exam involves placing a large bore needle in the bone marrow, usually of the iliac crest, and obtaining a specimen of its contents for microscopic exam. The test takes approximately one-half hour, is done by a hematologist, and may be performed in the patient's room or an office setting. Because of its relative ease and wealth of information yielded, bone marrow exams are fairly standard procedures.

One additional test may be obtained in a malabsorptive disorder to pinpoint the cause of a B12 deficiency -- the Schilling test. The Schilling test is required to confirm a diagnosis of pernicious anemia. The test is performed in a series of stages until one particular stage is abnormal. Each stage involves collection of urine for 24 hours. Since the urine specimen must be complete for diagnostic accuracy, the patient is often hospitalized.[103]

Thus, the work-up of an uncomplicated red blood cell disorder is fairly standard. However, one area where there is controversy is the extent of the work-up of a patient with iron deficiency anemia and evidence of blood in the stool. This is a common presentation in an elderly population and may have a variety of causes -- diverticulosis, peptic ulcer disease, angiodysplasia, colonic polyps -- but the possibility of colon cancer prompts the greatest

103 The Schilling test does not require hospitalization. Whether or not to admit depends in large measure on the reliability and motivation of the patient. Some patients find it difficult to collect all their urine for 24 hours.

alarm.[104] Diagnostic evaluation of this presentation includes the following possible tests: sigmoidoscopy, barium enema, upper gastrointestinal series, colonoscopy, upper endoscopy, and tagged red blood cell nuclear medicine scan. The number and order of these tests remains controversial. Many feel a sigmoidoscopy should come first. What next? A barium enema? That test is cheaper than a colonoscopy, but if a barium enema identifies a lesion, one may go to colonoscopy anyway to obtain a biopsy. This may require a wait since the barium must be cleared from the colon to optimize views of the colonic mucosal surface. Usually the lower gastrointestinal tract is investigated before attention shifts to the upper. The setting of this work-up is also flexible. Most patients are evaluated as inpatients mainly for convenience, not because of medical necessity. However, the frail elderly should be tested as inpatients because some of the tests hold greater risks for these individuals. Obviously choice of work-up procedures, timing, and site have significant cost repercussions.

In summary, the diagnostic approach to most red blood cell disorders is fairly limited compared to other diseases. An important exception is the the work-up of an anemia caused by slow blood loss from the gastrointestinal tract. Most of the tests are relatively inexpensive. Therefore, the cost of physician diagnostic services may be relatively greater in this area than others. Consultation with a hematologist or blood bank specialist may be quite important for hospitalized patients. However, this summary belies the complexity a physician may face when confronting the total patient. As emphasized above, red blood cell disorders affect or are affected by every

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104 Colon cancer accounts for 20% of deaths from malignancy in the United States; it is the second most common site for cancer in American men and third most common for women. Blood loss in the stool may be the first indication of this disease.

other organ in the body. The extent of resource use may well be dictated by these additional problems; this may prove exceedingly costly.

9.5 DIFFERENCES IN THERAPEUTIC APPROACH

Treatment of red blood cell disorders themselves incites relatively few controversies. If a deficiency anemia exists, replacement of the inadequate factor is the obvious therapy. If the patient is suffering acute posthemorrhagic anemia, the volume must be replaced by blood transfusions and other fluids. Initial treatment of a sickle cell crisis includes pain control and hydration. Even splenectomy -- major abdominal surgery -- is relatively non-controversial. Splenectomy is considered virtually curative for disorders such as hereditary spherocytosis.

One area where some dispute remains is treatment of aplastic anemia.[105] Bone marrow transplantation is now considered the optimal therapy for children and young adults with severe aplastic anemia, especially if no prior transfusions have been administered. (If a transplantation is performed, the patient would be reassigned to surgical DRG 394.) This treatment and its sequelae may require months of hospitalization, but has demonstrated superiority to other forms of treatment. Despite its heroic nature, even transplantation is not deemed curative. Appropriate therapy for older persons, persons with less severe disease, and those without suitable bone marrow donors is less clear-cut. Various immunosuppressive regimens have been tried; these have not been adequately tested by prospective, controlled trials. Treatment with androgens has also been touted as helpful, especially in patients with more mild disease. However, a recent controlled study of androgen therapy has not shown benefit, but this study was extensively criticized (only persons with severe disease were studied, perhaps the optimal

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105 Bruce M. Camitta, Rainer Storb, and E. Donnall Thomas, "Aplastic Anemia," New England Journal of Medicine 306 (1982): 712-718.

androgen was not used). Androgens may be toxic compounds, with liver damage as the most severe side effect. Therefore, appropriate therapy is unequivocal only in that small subset of patients for whom marrow transplantation is viable. Aplastic anemia is rarely completely cured.

This discussion concludes with the following caveat: although there may be relatively little controversy surrounding therapy for the red blood cell disorder per se, there may be considerable controversy revolving around treatment of other organ systems implicated in the anemia. Important examples are anemias related to underlying malignancy or a chronic inflammatory disease. Given this appropriately broader perspective, differences in therapeutic approach may be quite significant.

9.6 STATE DATA

The state data analyses for the red blood cell disorder DRGs are confounded by a major impediment -- ICD code comparisons suggest that the two states are treating different diseases (see Figure 9.1). This diagnostic discrepancy is similar to that observed in the diabetes DRGs (see Chapter 8) where the two states appear to have very different patients. But in that case, the discrepancy was along the single continuum of diabetes (more or less complicated disease). It was difficult to imagine that New Jersey diabetics were systematically "sicker" than North Carolina diabetics. The difference was attributed to disparate coding styles. However, in this instance the difference is not as easy to dismiss: sideroblastic anemia (prominent in North Carolina) is very different from sickle cell crisis (New Jersey); pernicious anemia (North Carolina) is very different from aplastic anemia (New Jersey). All clinicians know these differences. It is exceeding unlikely that a North Carolina physician would list pernicious anemia while a New Jersey physician would list aplastic anemia when confronted by the same patient and clinical data. The available data unfortunately cannot resolve this mystery.

Because of this problem, it is difficult to suggest precise reasons for the observed cost differential between New Jersey and North Carolina.[106] Part A costs averaged $2,190 in New Jersey and $1,674 in North Carolina; Part B costs averaged $569 in New Jersey and $322 in North Carolina.[107] Can different diagnoses account for any portion of this gap? Certainly other factors are of importance:

1. New Jersey patients are more likely to have a specialist as their attending physician than North Carolina patients (see Table 9.2).

2. North Carolina patients are more likely to be treated in a rural hospital than New Jersey patients (see Table 9.3).

TABLE 9.2

SPECIALTY OF ATTENDING PHYSICIAN

	PERCENT OF CASES[a]	
Specialty Name	New Jersey (N=2701)	North Carolina (N=2360)
General/Family Practice	21.8	37.1
Internal Medicine	61.6	53.9
Cardiology	5.3	1.2
Other	11.3	7.8
	100.0	100.0

a Chi-square comparison of New Jersey and North Carolina data yielded x^2=192.8, p<.001.

106 The ensuing discussion focuses only on DRG 395. As mentioned earlier, there are no cases in North Carolina DRG 396.

107 New Jersey and North Carolina means for both Parts A and B are statistically significantly different at the p<.001 level.

TABLE 9.3

NUMBER (PERCENT) OF ANEMIA CASES IN URBAN AND RURAL HOSPITALS

State	Urban	Rural
New Jersey	2,445 (91%)	256 (9%)
North Carolina	1,282 (54%)	1,078 (46%)

3. New Jersey patients are likely to stay in the hospital 2.31 days longer on average than North Carolina patients. In both states, urban hospitals have longer lengths of stay than rural hospitals. In New Jersey the differential is 1.88 days; in North Carolina it is 1.16 days (see Figure 9.2).

4. New Jersey patients are more likely to have specialist consultations -- particularly medical consultations -- than North Carolina patients. In both states, urban cases obtain more medical consultations than rural cases. The difference is particularly great in North Carolina, where the urban rate (26.7%) was more than three times the rural rate (8.2%). However, even the urban North Carolina rate is lower than the New Jersey rural rate. For surgical consultations the urban/rural differential is smaller. Interestingly, in New Jersey the rural surgical consultation rate (19.1%) is slightly higher than the urban consultation rate (16.0%, see Figure 9.3).[108]

To what extent, however, are New Jersey patients being followed by more specialists, remaining hospitalized longer, and obtaining more consultations because they have more serious diagnoses? In other words, are state practice patterns different in patients with identical diagnoses (at least identical ICD codes)? To explore these questions, several individual ICD codes were examined. The results appear in Table 9.4. Several patterns emerge, but each has its exceptions. In all diagnoses except sideroblastic anmeia, New Jersey

108 Interestingly, North Carolina had a higher overall x-ray rate than New Jersey -- 70.6% to 63.9%. However, from the data available, it is impossible to accurately determine the type of x-ray (e.g., to know whether New Jersey patients are obtaining more of the expensive CT scans while North Carolina patients receive cheaper conventional x-rays).

Figure 9.2
Length of Stay with Urban/Rural Splits:
RED BLOOD CELL DISORDER DRG 395

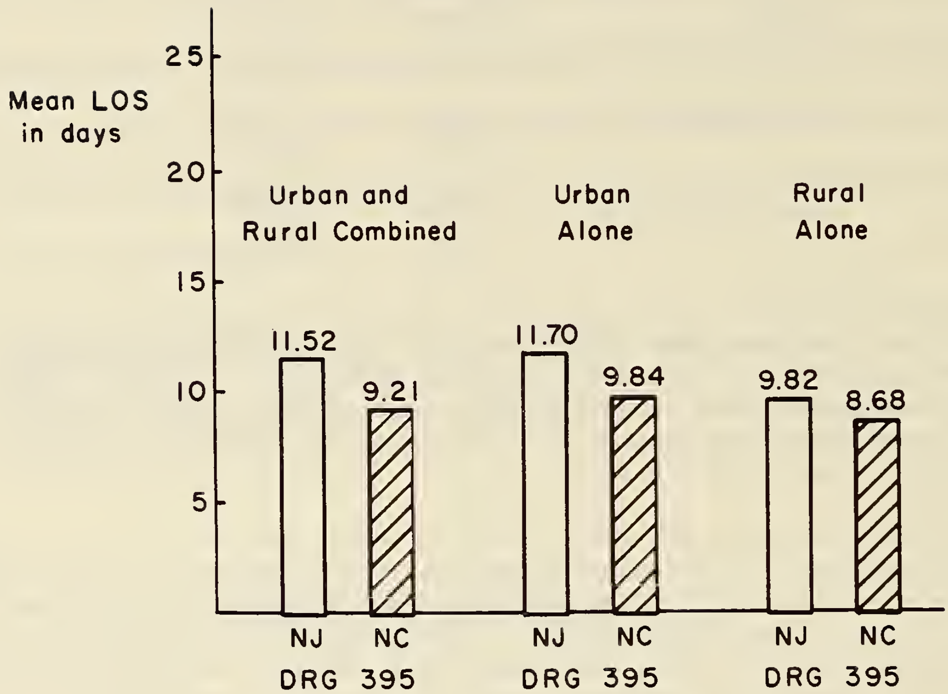

Figure 9.3
Percent of Patients Receiving Medical and Surgical
Consultations with Rural/Urban Splits
RED BLOOD CELL DISORDER DRG 395

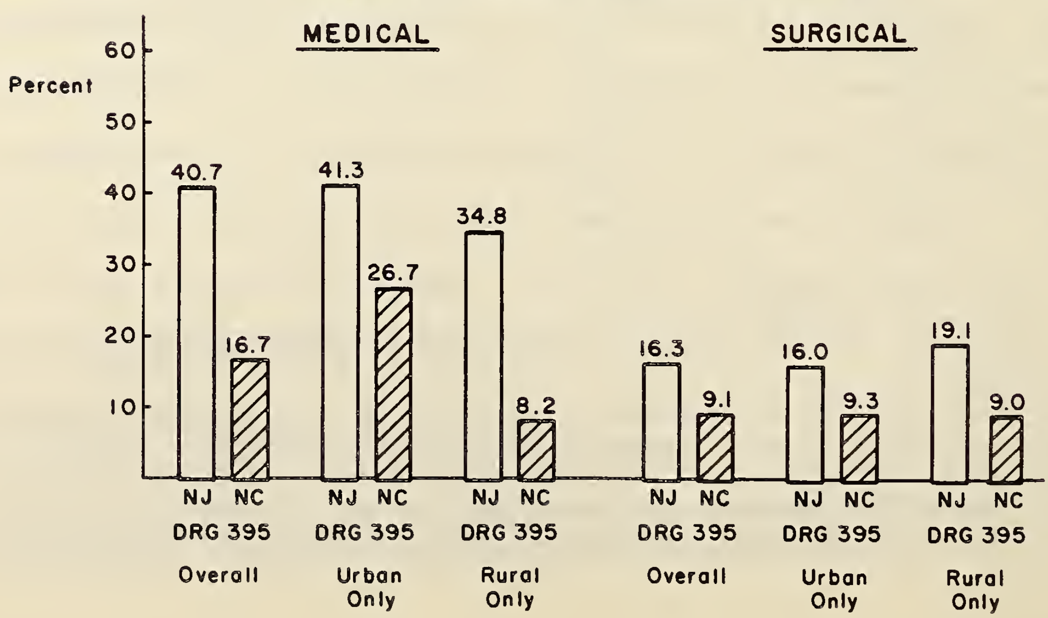

TABLE 9.4

NUMBER OF CASES, LENGTHS OF STAY, AND CONSULTATION

RATES BY ICD CODE DIAGNOSIS

Diagnosis (ICD Code Description)	NUMBER OF CASES		MEAN LENGTH OF STAY		PERCENT OF CASES WITH MEDICAL CONSULTATIONS	
	New Jersey	North Carolina	New Jersey	North Carolina	New Jersey	North Carolina
Unspecified Iron Deficiency Anemia	335	232	13.07	8.76	50.1	19.8
Pernicious Anemia	79	263	13.24	10.25	57.0	16.7
Sickle Cell Anemia with Crisis	120	29	10.63	8.21	14.2	13.8
Autoimmune Hemolytic Anemia	29	26	14.17	10.42	51.7	34.6
Sideroblastic Anemia	71	721	7.69	8.32	25.4	15.4
Aplastic Anemia Not Elsewhere Classified	123	44	11.56	9.35	36.6	34.1

patients remain hospitalized longer than North Carolina patients. Sometimes this differential is quite large (e.g., 4.31 days in unspecified iron deficiency anemia). In four of the six diagnoses, New Jersey patients have much higher medical consultation rates. It is interesting to note that the consultation rates are similar in sickle cell crisis and aplastic anemia -- two of the diagnoses in which New Jersey has greater caseloads. It thus appears that the discrepant practice patterns observed overall are not the result of a different diagnostic case mix.

Just as there are discrepant practice styles between the states, there are also probably varying practice styles within each state. This could account for a portion of the considerable cost heterogeneity observed in DRG 395 (see Table 9.5). But the more pressing clinical concern for this particular DRG is that the DRG lumps together multiple clinical entities. From clinical knowledge alone, some of these entities are expected to cost far more than others. In an attempt to improve cost homogeneity along clinical lines, DRG 395 was split as follows:

> Part B costs were compared at the individual ICD code level. Sixteen of the 41 possible ICD codes within DRG 395 were studied. Codes were examined only if they had 10 or more cases in either New Jersey or North Carolina. In many cases, the magnitude of costs did not match clinical expectations. For example, adult-acquired aplastic anemia was one of the cheaper diagnoses in North Carolina (although in New Jersey it was one of the more expensive). Whereas in other cases, costs equaled clinical expectations. Autoimmune hemolytic anemia, for example, was one of the

TABLE 9.5

PART A AND B COEFFICIENTS OF VARIANCE IN DRG 395

	New Jersey	North Carolina
Part A	0.9890	1.0710
Part B	0.9320	0.9390

most expensive diagnoses in New Jersey (although in North Carolina it was relatively cheap).

Because costs did not always agree with clinical expectations, splits were made more along cost than clinical lines. Two different attempts were made to split DRG 395 into more homogeneous cost categories. The Part B cost data were then grouped into these new categories. Means and CVs were computed; t-tests were performed to assess the differences of the new means. Results apper in Table 9.6.

The results of splitting DRG 395 are summarized below:

1. Only the first split manages to make two groups with significantly different mean Part B costs in both states.

2. The success of Split #1 was achieved only by cost considerations. The new groups still contain a clinically heterogeneous set of disease entities.

Thus, even though Split #1 accomplishes creation of two groups with different average costs, considerable cost variability remains. Why? Is the problem due to this last factor -- that Groups A and B continue to include multiple clinical entities? This is very possible, but it is unlikely that this clinical heterogeneity is adequately captured by the ICD codes. As shown in Figure 9.4, red blood cell disorder ICD codes incorporate cases with widely ranging costs. In addition, even the most specific ICD codes fail to explain much of the cost variation within DRG 395 (see Table 9.7). Therefore, it is difficult without additional information about the patient characteristics to know the contribution of this clinical heterogeneity to cost variation.

Despite these problems, this first split may serve as an example for potential modification of DRG 395. It is apparent that certain diagnoses are associated with significantly higher physician costs than others. To the extent that newly-created DRGs capture these differences, more equitable physician reimbursement may result.

9.7 IMPLICATIONS OF PROSPECTIVE REIMBURSEMENT FOR PHYSICIAN BEHAVIOR

The major clinical problem of DRGs 395 and 396 is definitional imprecision. Closely related to this imprecision is the severity of

TABLE 9.6

RESULTS OF SPLITTING DRG 395

Description of Splits	NUMBER OF CASES		MEAN PART B COST		CV		T-TEST ON MEANS[a]	
	New Jersey	North Carolina	New Jersey	North Carolina	New Jersey	North Carolina	New Jersey	North Carolina
Split #1								
Group A: Chronic blood loss, unspecified iron deficiency, pernicious, unspecified deficiency, autoimmune hemolytic, congential aplastic, unspecified anemia	2,057	1,287	$606	$349	0.9212	0.9391	t=7.99 p<.001 127, 209	t=5.21 p<.001 40, 88
Group B: Hereditary spherocytosis, sickle cell, adult aplastic, sideroblastic, acute posthemorrhagic, NEC anemia	545	998	$438	$285	0.9122	0.9364		
Split #2								
Group A: Autoimmune hemolytic, congenital and adult aplastic anemia	270	137	$492	$360	0.9141	1.2441	t=2.97 p<.01 30, 146	t=1.07 N.S. -34, 116
Group B: Chronic blood loss, unspecified iron deficiency, pernicious, unspecified deficiency, hereditary spherocytosis, sickle cell, sideroblastic, acute posthemorrhagic, NEC and NOS anemia	2,332	2,148	$580	$319	0.9338	0.9192		

a Includes minimum and maximum values of 95% confidence interval around difference in mean values for Groups A and B.

Figure 9.4
New Jersey Part B Costs of Selected ICD Codes: DRG 395

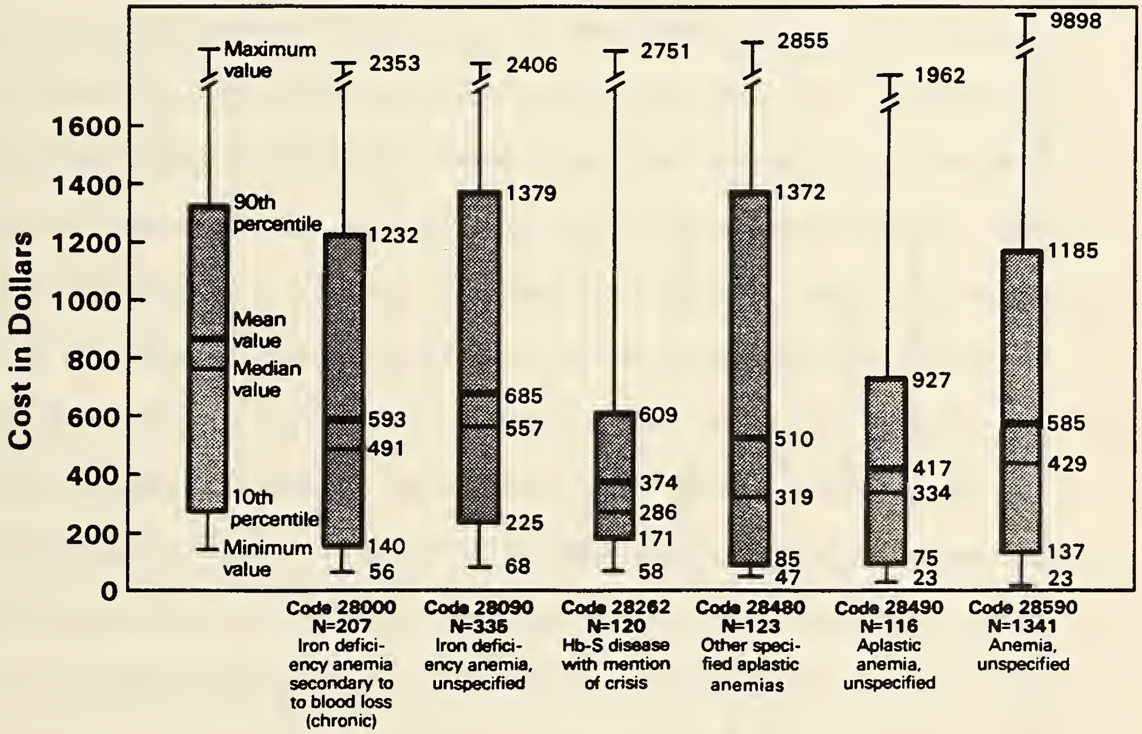

TABLE 9.7

R^2: REDUCTION IN VARIABILITY WHEN DRGS ARE SPLIT INTO ICD CODES

DEPENDENT VARIABLE

DRG	Part A Costs		Part B Costs		Length of Stay	
	New Jersey	North Carolina	New Jersey	North Carolina	New Jersey	North Carolina
395	0.017[a]	0.036[b]	0.033[b]	0.027[b]	0.014	0.026[b]
396[c]	0.096	--	0.113	--	0.125	--

a Significant at $p<.05$.

b Significant at $p<.001$.

c The numbers in DRG 396 are small.

illness -- varying severities both within and among the ICD classifications. The root of this problem is that the DRGs have grouped together "anemias" without clear appreciation that anemia is a symptom and not a diagnosis. Anemia may be caused by disease in a different organ system or it may cause disease in another organ system. Because of this, it is difficult to separate the anemia from its effects on the rest of the body. Thus, patients with anemia could reasonably fall into a wide range of DRGs.

Given that definitional imprecision is the primary clinical problem, it becomes difficult to separate Part A and Part B implications. Compared to some other DRGs, physician-specific issues are less pressing. For example, the diagnostic technologies are fairly limited. Consultants are not used as frequently given that many work-ups are somewhat routine. Need for consultant input may be dictated by the exigencies of the disease. If preliminary work-up yields a diagnostic dilemma, a hematologist would be needed to perform a bone marrow biopsy. Treatment of aplastic anemia is so complex that a specialist may be required. Finally, a patient needing multiple transfusions should be evaluated by a blood bank specialist. However, because of the involvement of other organ systems, the issue is clearly not simple. Appropriate consultations and diagnostic technologies must be determined by individual patient need. The following discussion emphasizes five areas which may be altered by use of a DRG-based prospective payment system. Due to this merging of Part A and B issues, the implications listed below will influence both hospitals and physicians.

First, because of the involvement of other organ systems, the red blood cell disorders are perfect candidates for "DRG creep." Depending on the reimbursement level, a patient could be assigned a principal diagnosis which would lead to a variety of DRGs. The DRG with the highest payment would probably be chosen. Examples are plentiful. The following discussion relies upon the relative weights listed in the September 1, 1983 Federal Register. In those examples listed below patients with anemia are assigned to a DRG other than 395. Keep in mind that the relative weight for DRG 395 is 0.7839.[109]

Patient 1 has chronic blood loss anemia (Code 28000). He has blood in his stool (melena). Melena (Code 57810) is grouped in DRG 175. The relative weight for DRG 175 is 0.8236.

Patient 2 has anemia of chronic disease (Code 28590) on the basis of rheumatoid arthritis (Code 71400). Rheumatoid arthritis is grouped in DRG 241. The relative weight for DRG 241 is 0.9048.

Patient 3 has iron deficiency anemia (Code 28090) on the basis of colon cancer (Code 15390). Colon cancer is grouped in DRG 173. The relative weight for DRG 173 is 1.0517.

Patient 4 has megaloblastic anemia (Code 28130) on the basis of a "vitamin deficiency" (Code 26920). Unspecified vitamin deficiencies are grouped in DRG 297. The relative weight for DRG 297 is 0.7923.

Patient 5 has acute posthemorrhagic anemia (Code 28510) on the basis of a ruptured aortic aneurysm (Code 44150). Ruptured aneurysms are grouped in DRG 131. The relative weight for DRG 131 is 0.9491.

Patient 6 has congestive heart failure (Code 42800) because of anemia. Heart failure is grouped in DRG 127. The relative weight for DRG 127 is 1.0408.

Patient 7 has salmonella osteomyelitis (Code 00324) because of sickle cell anemia. This osteomyelitis is grouped in DRG 238. The relative weight for DRG 238 is 1.5511.

Patient 8 has renal failure (Code 58490) because of sickle cell anemia. Renal failure without dialysis is grouped in DRG 316. The relative weight for DRG 316 is 1.3314.

There are fewer examples in which reassignment to DRG 395 (relative weight 0.7839) may yield pecuniary benefit. Several instances are described below.

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109 The alternative DRGs used throughout this discussion are those for patients without comorbidities and under age 70. If the DRGs incorporating advanced age and coexisting conditions were used, the relative weights would be higher and the incentive to move patients out of DRG 395 greater.

Patients 1 and 2 have vitamin B12 deficiency anemia (Code 28110) based upon celiac disease (non-tropical sprue, Code 57900) and blind loop syndrome (Code 57920) respectively. These diagnoses are grouped in DRG 183. The relative weight of DRG 183 is 0.5652.

Patient 3 has pernicious anemia (Code 28100) on the basis of gastric atrophy (Code 53789). Gastric atrophy is also grouped in DRG 183 which has a relative weight of 0.5652.

Patients 4 and 5 have aplastic anemia (Code 28490) based upon the use of the antibiotic chloramphenicol (Code 96020) and benzene exposure (Code 98020) respectively. Both these toxicities are grouped under DRG 450. The relative weight of DRG 450 is 0.5957.

The above examples illustrate that assignment of patients with red blood cell disorders is easily manipulated. This manipulation may enhance monetary returns and may make perfect clinical sense. Given that many of the anemias also qualify as acceptable comorbidities or complications (see Table 9.10), it is likely that the anemia diagnosis will most often be used to push a patient into a more lucrative DRG pertaining to another organ system (e.g., to move a patient with chronic blood loss anemia from DRG 175 to DRG 174: G.I. Hemorrhage Age > 69 and/or c.c., relative weight 0.9281). Thus, anemia will be listed as a secondary diagnosis rather than as principal diagnosis when it will yield additional reward. This strategy may in fact prove financially beneficial in most cases of anemia.

A second implication pertains to work-up setting. In the past, many anemia work-ups were performed in the hospital for the convenience of both physicians and patients. However, in most cases, work-up can probably be safely pursued in an outpatient setting. Consultations in non-emergent cases can also be obtained outside the hospital. Even patients who require transfusion support may be periodically transfused in an outpatient site with close nursing supervision. Blood bank assessment could also be performed at this time. The frail elderly form one major exception to this rule of non-emergent, outpatient evaluation. Even a procedure such as a barium enema may hold such risk for this population that inpatient assessment is essential.

TABLE 9.10

RED BLOOD CELL DISORDERS DEFINED AS COMPLICATIONS OR COMORBIDITIES

28000	Chr Blood Loss Anemia
28140	Protein Defic Anemia
28180	Nutritional Anemia NEC
28240	Thalassemias
28260	Sickle-Cell Anemia NOS
28261	Hb-S Disease w/o Crisis
28262	Hb-S Disease with Crisis
28263	Sickle-Cell/Hb-C Disease
28269	Sickle-Cell Anemia NEC
28300	Autoimmune Hemolytic Anem
28310	Nonautoimmune Hemolyt Anem
28320	Hemolytic Hemoglobinuria
28390	Acq Hemolytic Anemia NOS
28400	Congen Aplastic Anemia
28480	Aplastic Anemias NEC
28490	Aplastic Anemia NOS
28500	Sideroblastic Anemia
28510	Ac Posthemorrhag Anemia

A third implication involves those patients for whom anemia is an incidental finding. For example, a patient is admitted for treatment of pneumonia. Routine admission blood tests reveal an unsuspected anemia. Should the patient be kept in the hospital a few extra days while the anemia is explored? Or should he be sent home and readmitted later for evaluation? This behavior is equivalent to the split admission, although the second admission would be for a different disease process than the first. The incidental finding of anemia (with or without blood in the stool) is a fairly common occurrence. If anemia admissions are split from those of the other disease process, this could have important financial implications.

A fourth implication pertains to chronic diseases, most notably sickle cell disease. Patients with this disease may at times require monthly or even weekly hospitalizations. Under a PPS, there may be an incentive to admit patients with marginal crises and to discharge patients earlier than might have been past practice. If patients are discharged too soon, they may be readmitted sooner than expected. The end result of both strategies may be frequent, short admissions, and a higher total cost.

A final implication involves the vigor with which diagnosis is pursued. Physicians may choose to treat patients empirically (e.g., with iron supplements) rather than performing an extensive diagnostic work-up initially. If the patient responds, the retrospective diagnosis becomes "iron deficiency anemia." If he does not respond, specific diagnosis is pursued.

9.8 SUMMARY AND CONCLUSIONS

The anemias are common disorders, affecting both young and old. Although most anemias are ambulatory conditions, they account for thousands of hospital admissions nationwide each year. However, the number of patients hospitalized specifically for a red blood cell disorder belies the true number of persons with serious anemias. Anemia is often clinically perceived as a secondary diagnosis, next in importance to the impact of the anemia on a given organ system. As the clinical discussion emphasizes, anemias may affect virtually any organ in the body. Therefore, patients with anemias are probably subsumed under a broad range of DRGs.

The CVs for the red blood cell disorder DRGs are uniformly high. DRG 395, more important from the Medicare perspective, boasts CVs consistently greater than .93. The clinical perspective suggests that part of this cost variation may be due to definitional imprecision and varying severity of illness. The issue of differences in diagnostic and therapeutic approaches is not as important for these DRGs; the various options are not as expensive or as extensive as for other disease states.

Given this clinical concern, the 1982 Medicare analysis explored the possibility of splitting these DRGs into more homogeneous groups. When Part B costs were examined at the individual ICD code level, no clear patterns arose. For example, diagnoses which were clinically expected to be less costly were cheap in North Carolina and expensive in New Jersey; diagnoses which were clinically expected to be expensive were expensive in New Jersey and cheap in North Carolina. In addition, considerable physician cost variability remained at the individual ICD code level. Nevertheless, one split of DRG 395 along cost lines yielded two subgroups with significantly different physician costs. These subgroups thus may form the basis for more equitable physician reimbursement.

Given that clinical concern is focused upon definitional imprecision, it is difficult to separate the Part A and Part B issues. How will a DRG-based PPS affect physicians differently from hospitals? The answer must revert to the familiar argument: hospitals have large enough caseloads that costs will average out, but individual physicians may have small caseloads skewed on the severity continuum. This argument may be a valid concern given the epidemiology of some of the more serious red blood cell disorders. For example, sickle cell anemia occurs exclusively in persons of black heritage; physicians with large numbers of black patients would have a disproportionate number of patients with this serious disease. Similarly, thalassemias usually strike persons of Mediterranean descent. Physicians treating patients with this ethic lineage may have a larger caseload of these patients. Certain other anemias affect mainly the poor and alcoholics. Physicians with urban ghetto practices would certainly see a larger number of these very sick patients.

Therefore, depending on the ethnic and socioeconomic mix of his caseload, an individual physician may indeed have more seriously ill patients. Despite this, the perverse incentives under a PPS may be identical for hospitals and physicians. Several examples are as follows:

1. DRG Creep. The red blood cell disorders present the perfect opportunity for DRG creep. Hospitals have an incentive to move patients into the most profitable appropriate DRG. Physicians would have the same incentive. Thus, financial incentives would dictate the ordering of the anemia diagnosis, either as the principal or secondary diagnosis.

2. Work-Up Setting. Hospitals have an incentive to move testing from an inpatient to an outpatient setting. Physicians would have the same incentive, both for testing and consultations.

3. Case Mix. Hospitals have an incentive to admit patients with marginal indications. Physicians would have the same incentive.

4. Split Admissions for Incidental Findings. In patients admitted for treatment of an unrelated disease, what should be done about the incidental finding of anemia? Hospitals have an incentive to release patients once treated for their first illness, then readmit them for evaluation of the anemia. Physicians would have the same incentive.

5. Empirical Therapy. Hospitals have an incentive to minimize work-up; physicians have the same incentive. Patients with a mild anemia found as an incidental finding may be treated empirically with a

course of iron supplements, for example. If they respond, iron deficiency anemia is (retrospectively) diagnosed, and work-up avoided.

6. Discharge Timing. Certain diagnoses require repeated hospitalizations; often the clinical endpoint of these hospitalizations is unclear. Hospitals have an incentive for early discharges, with multiple short admissions. Physicians would have the same incentive.

Providing identical incentives to hospitals and physicians is a concern which must be addressed in the design of the reimbursement system. If certain physicians are particularly hard-hit by the PPS (e.g., those physicians treating mainly poor or black patients), the urgency of these incentives may be heightened. In these cases, a conscious trade-off may be required between financial concerns and access to good quality care.

9.9 CLINICAL APPENDIX[110]

The red blood cell is a highly specialized cell which carries oxygen to the body's tissues. Following a series of complicated maturational steps, the "adult" red blood cell emerges from its birthplace, the bone marrow, along with the two other cellular components of blood: white blood cells, which combat infection; and platelets, which regulate blood clotting. Normal mature red blood cells are shaped as a biconcave disc and are rich in the complex molecule hemoglobin. Iron-containing hemoglobin imparts its characteristic red coloring to red blood cells. More importantly, hemoglobin is the seat of oxygen transport. Oxygen is bound by a specific niche in the molecule; in oxygen-starved tissue, the hemoglobin changes shape and releases its charge. Because of the uniform size, color and shape of red blood cells, it is easy for a trained viewer to suspect certain red blood cell problems just by looking at a blood smear (a glass slide coated with a thin layer of blood) under a microscope. There are many causes of anemia, as follows:

1. Decreased Production. Disorders of impaired production of red blood cells are generally grouped by the morphology of the cells. As noted earlier, on a normal smear, red blood cells are remarkably uniform in size, shape and color.

   a. Hypochromic, Microcytic Anemias. In these anemias, red blood cells are pale (hypochromic) and small (microcytic).

      (1) Iron Deficiency Anemia (Codes 28000 through 28090). This is the most common anemia world-wide. It results when inadequate iron is available for bone marrow hemoglobin synthesis. Iron must be

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110 H. Franklin Bunn, "Anemia," in Principles of Internal Medicine, Robert A. Petersdorf et al. eds., New York: McGraw-Hill Book Company, 1983: 282-291.

furnished in the diet; it is absorbed in the first portion of the small intestine. Iron deficiency anemias are lumped into three groups based on etiology:

(a) Inadequate Intake of Iron (Code 28010). This cause is common in the poor and elderly due to inadequate consumption of animal products (because of high cost, poor dentition).

(b) Decreased Absorption of Iron (Code 28080). This results in patients who have had their stomachs removed (e.g., for peptic ulcer disease, malignancy) and in certain patients with chronic diarrhea and malabsorptive syndromes.

(c) Increased Loss of Iron (Code 28000). Chronic slow blood loss results in iron-deficiency anemia. In women of child-bearing age, menstrual loss is the most common cause. However, this is an important problem for the elderly because many common gastrointestinal disorders may first present as iron-deficiency anemia. Colon cancer and diverticulosis are two common examples.

(2) Deficient Iron Utilization: Sideroblastic Anemia (Code 28500). In this disorder, the body contains adequate iron stores, but lacks the capacity to use iron effectively. It is thought to result from defects in the enzymes which incorporate iron into hemoglobin. Several types have been identified. A hereditary form is usually identified in early adulthood. Certain drugs or toxins have been implicated in the genesis of sideroblastic anemia. Isoniazid, an anti-tuberculosis drug, and lead are common culprits; alcohol is also important (30% of hospitalized alcoholics have this anemia; it improves upon alcohol withdrawal). Sideroblastic anemia may be associated with malignancies or chronic inflammatory disorders (e.g., leukemia, lymphoma, rheumatoid arthritis). Finally, an idiopathic (unknown cause) form is common in the elderly. The anemia may be very mild, or the patient may become transfusion dependent. This form of sideroblastic anemia may be a preleukemic condition, with 10% of patients progressing to an acute nonlymphocytic leukemia.

b. Normochromic, Normocytic Anemias. In these anemias, the red blood cells are normal in color (normochromic) and size (normocytic).

(1) Aplastic Anemia (Codes 28400 through 28490). Severe aplastic anemia is a life-threatening disorder and is considered a medical emergency. It is caused by failure of the bone marrow. When bone marrow is aspirated and examined under the microscope, it appears fatty or empty, instead of filled with normal cells in various maturational stages. Obviously since the patient's own marrow is not replacing red blood cells (the lifespan of a mature red blood cell in the bloodstream is 120 days), multiple transfusions may be necessary. Two forms of aplastic anemia are recognized.

(a) Congential (Fanconi's Anemia) (Code 28400). This form of aplastic anemia is associated with multiple birth defects and chromosomal abnormalities. Its victims generally die in childhood.

(b) Acquired. The acquired form is often linked to drug and toxin exposures. Commonly implicated compounds include such drugs as chloramphenicol (an antibiotic), gold (used in treatment of rheumatoid arthritis), and barbiturates, and such toxins as benzene, cleaning solvents, and insecticides. Aplastic anemia may also develop following infectious hepatitis. One final cause is high-dose, total body irradiation.

(2) Anemia of Chronic Diseases (Codes 28580, 28590). Chronic diseases of other organ systems or disorders involving chronic inflammation (e.g., tuberculosis, rheumatoid arthritis) have been associated with impaired red blood cell production. The most severe of these anemias is associated with chronic renal failure: the kidneys secrete a hormone called erythropoieton which stimulates red blood cell production; diseased kidneys produce less hormone. Failure of endocrine organs (e.g., thyroid, adrenals, gonads, pituitary) have been associated with a mild to moderate anemia. Protein depletion causes a state similar to the hypometabolism of endocrine failure and thus results in anemia. Finally, liver disease also causes a mild to moderate anemia. This is especially true if the liver disease is alcohol-induced; alcohol has a direct suppressive effect on the bone marrow.

c. Megaloblastic Anemias (Code 28130). In these anemias, the red blood cells may be normal in color but large (megaloblastic) in size. They are all caused by impaired DNA synthesis in red blood cell production, and mainly result from deficiencies in the critical compounds folic acid or vitamin B12. A less common cause is exposure to anti-cancer drugs.

(1) Folic Acid Deficiency (Code 28120). Folic acid is obtained through ingestion of fruits and vegetables. A deficiency can occur within months of curtailed consumption of these foods, and is thus common in alcoholics and elderly persons who have lost interest in food. Folic acid deficiencies may also occur when bone marrow demand for the compound overpowers supply (e.g., patients with malignancies or on hemodialysis).

(2) Vitamin B12 (Code 28110). B12 is an essential vitamin only found in meat and dairy products. Fortunately, the body stores B12, and it takes three to six years for a deficiency to develop. Therefore, only in long-term, strict vegetarians is inadequate intake the cause of B12 deficiency. In others B12 malabsorption is the root of the deficiency. Once foods containing B12 are swallowed, absorption into the bloodstream is a complicated process. Specialized cells in the stomach secrete a protein called intrinsic factor. Intrinsic factor must bind B12 in the

first part of the intestine (duodenum) before the complex can be absorbed in the last part (terminal ileum). Disorders of B12 may be due to:

(a) Inadequate Production of Intrinsic Factor. This is obviously a problem if the patient has had his stomach surgically removed. But it is also a problem if the stomach lining has atrophied (wasted away). The disorder resulting from gastric atrophy is termed pernicious anemia (Code 28100). Pernicious anemia is a common disease of the elderly. Its prevalence is highest in persons of Northern European descent; it is rare in blacks and orientals. Diagnosis of pernicious anemia is essential since, apart from its hematologic complications, it may lead ultimately to irreversible damage of the nervous system.

(b) Disorders of the Terminal Ileum. Diseases which affect this specialized site of B12 absorption may result in megaloblastic anemia.

(c) Competition for B12. After stomach or small intestinal surgery, certain conditions may encourage overgrowth of bacteria (bacteria always live in the colons of healthy individuals, but they rarely reside in the small intestine). Some of these bacteria compete for consumption of B12. A problem generally limited to Scandinavian countries is competition from the fish tapeworm parasite, *Diphyllobothrium latum*.

Differentiating these causes of malabsorption is essential before proper therapy can be started.

2. Destruction in the Body: Hemolytic Anemias (Codes 28300 through 28390). The red cell can run into multiple problems in the bloodstream which may result in its destruction. The hemolytic anemias are a broad grouping of these events, and represent a wide variety of disorders. A discussion of the most common problems follows.

   a. Immunological Destruction (Code 28300). The body has a mechanism for attack against foreign cells -- an immune system. The immune system recognizes these outsiders by identifiers on the cell surface and destroys these cells. The best known cell surface markers for red blood cells are the A, B and O blood types and the Rh- factor. Incompatibilities along these lines would be the basis for a flagrant transfusion reaction (if, for example, a person with Type A negative blood were transfused with Type B positive blood). However, there are many other markers on the red blood cell's surface; each may be the basis of a transfusion reaction (Codes 99960 through 99980). Blood bankers have adopted strigent standards to minimize these reactions, but because of the complexity of the red blood cell surface, exact matching of blood is virtually impossible. Most transfusion reactions are mild -- flushing or itching. But a flagrant reaction can result in death.

Occassionally the body can perceive its own cells as foreigners. This situation is associated with certain drugs (for example, the antibiotic penicillin, the anti-hypertensive α-methyldopa, and the anti-arrhythmic quinidine). Most often the cause is idiopathic, unknown. In this case, the body's immune system destroys its own red blood cells, and a hemolytic anemia ensues.

b. Mechanical Factors (Code 28580). Red cells are fragile structures. Mechanical trauma can easily destroy them. The turbulent flow around an artificial heart valve, for example, can cause hemolytic anemia. So can the high pressure conditions of malignant hypertension. Even the pounding from joggers running in thin-soled shoes may result in "march" hemolytic anemia, albeit relatively mild.

c. Abnormal Red Blood Cell Membrane. The membrance encasing the red blood cell is an incredibly complex structure. If the membrane is not properly constituted, it may be more easily torn and the red blood cell more easily destroyed. For example, liver disease may derange the lipid composition of the membrane, decreasing red blood cell survival. Two relatively rare genetic disorders involve abnormal membrane production; both occur approximately one in 4,500 persons. In hereditary spherocytosis (Code 28200), the red blood cells are spheres rather than biconcave discs, and in hereditary elliptocytosis (Code 28210) the red blood cells are ovoid. In both disorders, the spleen (an organ of the immune system) literally eats these abnormal cells. Removal of the spleen is curative; this is generally done in childhood.

d. Abnormal Red Blood Cell Enzymes (Code 28220). Enzymes are specialized proteins which enable certain chemical reactions to take place. Cells are full of enzymes, and red blood cells are no exception. A particularly important red blood cell enzyme is glucose-6-phosphate dehydrogenase (G6PD); this enzyme helps prevent red blood cell destruction by oxidant poisons. G6PD is linked to the female (X) chromosome. Therefore, almost all individuals suffering G6PD deficiency are males. There are many variants of G6PD deficiency. One variant affects about 15% of black American men; a more severe variant occurs in men of Mediterranean descent. Generally persons with these deficiencies are totally healthy. However, a hemolytic anemia may result when they are stressed by viral or bacterial illnesses, or when they consume certain drugs or foods (e.g., sulfa drugs, antimalarials, fava beans).

e. Abnormal Hemoglobin. Hemoglobin is a complicated molecule, formed by the intertwining of four chains, two α chains and two β chains. When the hemoglobin is defective, the whole red blood cell becomes unstable and is liable to collapse or be destroyed. Two major hemoglobin disorders (hemoglobinopathies, Code 28270) are recognized: sickle cell anemia and the thalassemias.

(1) Sickle Cell Anemia (Code 28260). This anemia is a genetic disease (autosomal recessive) caused by substitution of one amino acid on the β hemoglobin chain. It occurs only in persons of black descent. Sickle trait (Code 28250) occurs when persons

have one sickle gene; 8% of American blacks have sickle trait. These individuals are generally healthy. Sickle cell anemia results when two sickle genes are present; 0.15% of black Americans are born with this condition. These children are often in and out of hospitals many times each year. The illness is often lethal, killing its victims by young adulthood.

The major event in the progression of sickle cell anemia is the painful crisis (Code 28262). Sickle crises usually occur during periods of stress (e.g., an infection). Because of excess demand, oxygen content in the blood may be lower than normal. When exposed to low oxygen, the abnormal sickle cell hemoglobin collapses, and the red blood cell deflates. The collapsed cell forms a cresent or sickle shape. In this form it is too rigid to pass easily through the tiny blood vessels, and blood flow to small areas may be cut off. When blood flow is suspended, tissue dies and pain ensues. Often the pain is so great that narcotics are required for palliation.

Crises may occur weekly or monthly or may sometimes abate for periods of several years. These crises may lead to failure of a number of organs due to recurrent cell death. The lungs, kidneys, spleen, eye, skin, bone and brain are particularly affected. Sometimes symptoms of a crisis may exactly mimic biliary colic or appendicitis. Exploratory abdominal surgery may be necessary to differentiate the two. Long-term sequela of sickle cell anemia include renal failure, stroke, blindess, gallstones, drug addiction (from frequent narcotic use), and increased susceptibility to infections.

(2) Thalassemia (Code 28240). The thalassemias include a heterogeneous group of hemoglobinopathies. They all involve imbalanced production of the α and β hemoglobin chains. The abnormal chains form clumps in the red blood cell, resulting in its destruction. Thalassemia genes are very common in selected populations. For example, 10% of persons in the southern Italian and Mediterranean regions carry a β thalassemia gene. The gene is also common in blacks, and many American blacks have one sickle and one thalassemia gene.

Thalassemias run the gamut from mild to lethal disorders. For example, many individuals have no clinical symptoms of the disease and may thus escape detection. The most severe form is called β-thallasemia major (Cooley's anemia). This disorder usually presents within the first six months of life. Transfusions are required to maintain red blood cell levels, and the patients usually do not survive to adulthood.

3. Outright Blood Loss (Code 28510). The most obvious cause of anemia is massive bleeding. This occassionally occurs when a major blood vessel bursts; common examples are a peptic ulcer or tumor invading a vessel or rupture of an aortic aneurysm. Sudden loss of one-third of the blood volume is fatal. Slower loss of an equal volume is better tolerated, but is also a medical emergency. Immediate blood transfusion is essential, life-saving therapy.

Chapter 10

SUMMARY AND CONCLUSIONS

10.1 DEFINITIONAL PRECISION

As described in the introduction to this report, one of the primary goals of the DRG designers was to create clinically homogeneous categories, groupings which physicians could "relate to." This goal faced an obvious trade-off with the simultaneous desire to minimize the number of groups. Each of the seven preceding clinical analyses began with this issue of definitional precision: how well do the DRGs group clinically similar sets of diagnoses? The answer to this question is not always straightforward, but may be summarized as follows:

1. On one level the answer is generally no. If one assumes that ICD codes accurately reflect diagnosis, DRGs often group together clinically heterogeneous diseases.

2. On a second level, the answer becomes a question: does it matter? Certain statistical results suggest that one would not do much better (in terms of grouping cases with like resource consumption patterns) by breaking down cases into the 10,241 individual ICD-9-CM codes.

This section expands upon these two levels of response to the question of definitional precision. Because these issues are generic to DRGs, they bear implications for both Part A and B reimbursement policies.

Some DRGs fare better than others in terms of grouping together homogeneous clinical entities. For example, DRG 15: Transient Ischemic Attacks is very precisely defined. The pneumonia DRGs, 89 and 90, are as precisely defined as is often clinically reasonable: it is sometimes very difficult to determine the exact etiology of a pneumonia without involving expensive, invasive technologies. However, other DRGs do not do as well. Some appear promising from the neatness of their titles -- DRG 82: Respiratory Neoplasms, DRG 294: Diabetes Age > 36. In others, the clinical heterogeneiity is reflected in their broad nomenclature (e.g., gastrointestinal hemorrhage, atherosclerosis, red blood cell disorders).

At the outset, for example, DRG 82 appears to pertain mainly to lung cancer. But upon examining the ICD codes which comprise that DRG, it becomes clear that the DRG encompasses a broad range of malignancies. Not only does it include the different tumor types of the lung (which may have widely varying biologic behavior and resource needs), but it also includes tumors metastatic to the lung. The list of tumors which metastasize to the lung is exceedingly long.[111] Similarly, DRG 294 not only includes simple diabetics, but it further encompasses diabetics with renal failure, neurologic dysfunction, coma, and so on. These are distinct clinical entities as well as different severity manifestations.

In other DRGs the clinical heterogeneity is more obvious. For example, the gastrointestinal hemorrhage DRGs, 174 and 175, incorporate bleeding at any point in the gastrointestinal tract -- from the esophagus to the anus. Although principles of initial medical management of these disorders may be similar (e.g., for severe bleeds, maintaining blood pressure and fluid balance), the specific diagnostic and therapeutic options may be very different.

The fervor with which this assessment of clinical homogeneity within the DRGs can be pursued must be tempered by certain realizations. First, one can only proceed so far by using discharge ICD codes as the only clinical clue. This problem will discussed in depth in Sections 10.2 and 10.3. Second, there may be practical constraints on the number of allowable groupings. What if,

111 This allows opportunity for DRG creep as follows: If a patient has a tumor which has metastasized to the lung, that tumor could be listed as the principal diagnosis with the lung metastasis as the secondary. The ordering of diagnoses could be switched if the reimbursement was higher for the respiratory neoplasm DRG than for the DRG of the original tumor type.

however, these constraints were lifted and one were allowed as many groups as possible? Would a reimbursement system fare better if cases were classified according to each of the 10,241 ICD-9-CM codes?

As a preliminary attempt to answer this question several statistical analyses were performed and are highlighted in Chapters 6, 8, and 9.[112] Costs were first aggregated around individual ICD codes. Considerable cost variability remained (see Figures 6.5, 8.4, and 9.4). The most specific angina pectoris code, 41300, for example, retained a Part B CV of 1.4636 in North Carolina (1,771 cases). The more general code, angina pectoris unspecified, 41390, actually had a slightly lower CV of 1.4577 (1,762 cases).

The question was then approached from the opposite vantage. An analysis of variance (ANOVA) was performed by splitting the DRG caseload into ICD groupings and looking at the amount of within DRG variance explained by this procedure (see Tables 6.8, 8.8, 8.9 and 9.7). For example, within the ICD rubric, diabetes mellitus codes are actually fairly precisely defined. However, the ICD code groupings explain only a small proportion of the variability within DRG 294 (ANOVA R^2 results with Part B as the dependent variable was 0.050 in New Jersey and 0.021 in North Carolina). With the hypothesis that perhaps the poorly defined ("unspecified") codes were reducing the explanatory power, the ANOVA was repeated after removing cases in these codes. The results were even poorer, with the R^2 in New Jersey equalling 0.035 and in North Carolina 0.018.

Thus, the reduction in variability when DRGs are split into ICD codes is fairly minimal. This result may be interpreted in a number of ways, but must always be viewed in light of the remaining cost heterogeneity within each ICD code. Clearly, basing a reimbursement system upon over 10,000 diagnosis codes

112 Similar results for all statistical analyses were found for the other four clinical examples in both New Jersey and North Carolina.

may not make a substantial improvement. But it may be possible to make changes in the DRGs at the margin to make them more clinically homogeneous and perhaps a fairer basis for physician reimbursement. Returning to the diabetes example, DRG 294 was split into two subgroups using four different methodologies. Three of the four cases succeeded in creating subgroups with significantly different mean Part B costs in both states. For example, in New Jersey, Split #2 yielded groups with mean Part B costs of $843 and $406; Split #3 produced groups with mean Part B costs of $793 and $390. A similar exercise was likewise successful for red blood cell disorders.

In summary, definitional imprecision is an important clinical problem for the DRG system. However, a reimbursement methodology may not be substantially improved by disaggregating cases into the smallest possible diagnostic groupings. Some improvements may be made by splitting DRGs along clinical and cost lines. Perhaps one important reason for enhancing clinical homogeneity is to maximize the appeal of the DRG classification scheme to physicians. Physicians are likely to be dissatisfied by any methodology which groups together multiple different clinical entities.

As alluded to throughout this discussion, part of the blame for these failings may be attributed to the ICD code and discharge abstract quality. These issues are addressed in the next two sections.

10.2 DATA QUALITY

The clinical analysis of the ICD coding practices within DRGs yielded ample evidence of regional differences in coding styles and the suspicion that there may be considerable variability in data quality. The most prominent clinical examples are as follows:

1. Both states rely heavily on the "NOS" (not otherwise specified) and "NEC" (not elsewhere classified) codes for grouping their patients. This suggests that the information from which the code is derived is exceedingly general, and in fact could represent a wide variety of

clinical entities. This practice may match clinical reality in certain instances (for example, it may be clinically unreasonable to pinpoint the exact etiology of pneumonia). But in others (e.g., gastrointestinal hemorrhage) appropriate treatment may demand an accurate diagnosis.

2. Within the same disease constellation, the states appear to code differently. For example, New Jersey diabetics are generally designated as "complicated" whereas North Carolina diabetics are described as "uncomplicated." In the area of cardiovascular disease, New Jersey patients tend to receive a clinical diagnosis (angina) whereas North Carolina patients tend to receive a pathologic diagnosis (coronary atherosclerosis).

3. The states sometimes emphasize totally different diseases. For example, large numbers of New Jersey patients are coded with aplastic anemia and sickle cell disease, whereas pernicious anemia and sideroblastic anemia dominate North Carolina's caseload. Although 30.6% of North Carolina anemia cases were listed as sideroblastic anemia, only 4.5% apparently had bone marrow exams. Yet this is a diagnosis which is based upon observation of a specific cell type the bone marrow.

4. Some of the coding in fact appears inaccurate. For example, 25% of North Carolina lung cancer cases are listed as malignant neoplasms of the trachea. Yet, primary cancers of the trachea are extremely rare. Most likely these cases represent common bronchogenic tumors of the upper lung which have invaded the trachea.

Although this study did not return to the patient chart to validate discharge diagnosis, these data suggest certain quality problems. Each of the four examples listed above would not cause a patient to be reassisnged to other DRGs. But this sloppiness is of concern and could, in some cases, allow for manipulation of DRG assignment. Poor discharge data quality is a generic concern and has been amply documented by other researchers.

In the late 1970s, the Institute of Medicine (IOM) conducted three extensive studies on the subject of hospital discharge abstract quality. The principal conclusion of these studies was that there is a significant amount of imprecision and error in hospital discharge data. When data abstracted by IOM field workers was compared with that of the original data source, substantial discrepancies (disagreement in determination of correct diagnostic and surgical codes) were detected. Discrepancies in the coding of discharge diagnoses ranged from 34.8% to 41.6%, and surgical procedure discrepancies ranged from 21.1% to 28.6%.[113] The discrepancies between the original coding and recoding by the IOM field team were most often due to "a difference of professional opinion in interpreting the medical record" suggesting that "for any aggregate sample of abstracts, a sizeable portion will not be reliable in the sense of being coded similarly on repeated occasions. Furthermore, there is no identifiable or correctable 'error'."[114] This problem arose from the difficulty of determining which diagnosis should be regarded as principal. This suggests that for some patients it may be very difficult to accurately define a single diagnosis responsible for admission to the hospital. The determination of a principal diagnosis is especially difficult for elderly medicare patients who often present with multiple complex medical problems.[115]

In 1983, Doremus and Michenzi published the results of a study in which they also examined the problem of medical record data quality.[116] Diagnostic and surgical data from three sources (the Medicare billing form, the original medical record data, and reabstracted record data) in a large teaching hospital were compared. Analysis was conducted to determine the effect of coding discrepancies on DRG classification and the resulting Medicare reimbursement schedule. The authors concluded that there is "widely divergent diagnostic and surgical data that result in a significant variation in DRG classification and reimbursement ceilings."

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113 Institute of Medicine, Reliability of Hospital Discharge Abstracts, Washington, D.C.: National Academy of Sciences, 1977.

114 Ibid, pp. 26-27.

115 Institute of Medicine, Reliability of Medicare Hospital Discharge Records, Washington, D.C.: National Academy of Sciences, 1977.

116 Harvey D. Doremus and Elena M. Michenzi, "Data Quality: An Illustration of Its Potential Impact upon a Diagnosis Related Group's Case Mix Index and Reimbursement," Medical Care 21 (1983): 1001-1011.

These findings have serious implications for any reimbursement system based upon hospital discharge data. The significant problems with data reliability that have been demonstrated suggest that the use of these data to determine hospital case mix and Medicare reimbursement levels may be inappropriate. Even if data quality improves (as expected under the prospective payment system), it may ironically result in increased costs, as more attention is paid to diagnosis and DRG assignment.

10.3 INTERNATIONAL CLASSIFICATION OF DISEASES - 9 - CLINICAL MODIFICATION CODES AS A REIMBURSEMENT TOOL

The seven clinical chapters repeatedly emphasize the shortcomings of the ICD-9-CM nomenclature for reimbursement purposes. A more fundamental clinical concern is that the ICD codes also often fail to accurately reflect the clinical diagnosis of the patient. This issue arises because the ICD system intermingles different "levels" of diagnosis (e.g., symptom, clinical diagnosis, pathologic process, clinical event) without clearly delineating these differences. Because of this, DRG were created which are often not clinically mutually exclusive. This problem will be discussed in detail in this section, but first it may be helpful to place the ICD system in context.

From its genesis the ICD system has been a global undertaking. It arose from a desire of the 1853 International Statistical Congress in Brussels to uniformly code cause of death worldwide. But its exact purpose has always been somewhat obscured by the differing needs of all the countries which use it. This problem of competing goals was anticipated by William Farr, the first medical statistician of Great Britain's general register and one of the leaders of the 1853 conference:

> Classification is a method of generalization. Several classifications may, therefore, be used with advantage; and the physician, the pathologist, or the jurist, each from his own point of view, may legitimately classify the diseases and the causes of

> death in the way that he thinks best adapted to facilitate his inquiries, and to yield general results.
>
> The medical practitioner may found his main division of diseases on their treatment as medical or surgical; the pathologist, on the nature of the morbid action or product; the anatomist or the physiologist on the tissues and organs involved; the medical jurist, on the suddenness or the slowness of the death; and all of these points well deserve attention in a statistical classification.[117]

In this statement Farr may also have anticipated the strategy that would be used over the ensuing 131 years to accommodate multiple objectives -- additions to and modifications of the original system as new needs arose. The system appears never to have been scraped and rebuilt from the bottom up; it retains much of its orginal emphasis on "grouping diseases by anatomical site."[118]

Demands on this classification system have spawned a number of modifications for American consumption (e.g., ICD-Adapted in 1959, Hospital-Adapted-ICD in 1968). However, no ICD volume has specifically targeted reimbursement needs. "...The furnishing of clinical descriptions of patients is a new and largely unrecognized development...diagnosis and procedure codes must be more precise than they need to be for statistical groupings and detection of epidemiologic trends."[119] This provided the impetus for the increased coding detail found in the latest version (ICD-9 has 9,607 codes compared to ICD-8's 3,004 codes). Even this enhanced specificity did not adequately meet American needs; therefore, the ICD-9-Clinical Modifications volume (10,241 codes) was developed. It was generated by committee and represents compromises on numerous different goals and agendas.

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117 Robert A. Israel, "The International Classification of Diseases: Two hundred years of development," Public Health Reports 93 (1978): 150.

118 Ibid., p. 151.

119 Vergil N. Slee, "The International Classification of Diseases: Ninth Revision," Annals of Internal Medicine 88 (1978): 424-425.

ICD-9-CM integrated more clinical detail by adding mandatory fifth digits to each code. But even its designers did not explicitly address use of these codes for reimbursement purposes. Resource consumption patterns were never a factor in designation of ICD codes.

However, because ICD-9-CM code was the piece of diagnostic information mandated to appear on the uniform hospital discharge abstract, it has become the diagnostic cornerstone of a number of case mix methodologies, including the DRG system. By taking the ICD nomenclature at face value without making any adjustments, the DRG system has fallen into one of the ICD's major traps. One of the five important objectives of the DRG designers was:

> There must be a manageable number of classes, preferably in the hundreds instead of thousands, that are mutually exclusive and exhaustive. That is, they must cover the entire range of possible disease conditions in the acute care setting, without overlap.[120]

Technically, these goals were achieved. Using DRG decision rules and other patient information (e.g., age), a given ICD code directs each case into only one DRG. But clinically, DRGs may not be mutually exclusive; there may be substantial overlap. This presents the perfect opportunity for medically correct manipulation of diagnosis to maximize reimbursement.

Chapter 6 contains an extensive discussion of this problem of clinical overlap in some of the cardiovascular DRGs. The conclusion was that four DRGs pertain to virtually identical patients, separated only by the level of diagnosis assigned the patient: symptom (DRG 143: Chest Pain), clinical diagnosis (DRG 140: Angina), or pathologic process (DRGs 132, 133: Atherosclerosis). In fact some of the ICD code caseloads across these DRGs have very similar mean Part B costs. Since a patient could be assigned any of

120 R.B. Fetter et al., "Case Mix Definition by DRGs," Medical Care 18 (1980 Supplement): 5.

these three levels of diagnosis, it would be clinically totally justifiable to assign the patient to the DRG with the highest reimbursement.[121]

This cardiovascular example is not an isolated incident. Delving further into this practice, one can identify multiple points where this may occur. One involved the codes for septicemia and respiratory failure and is discussed at length in the pneumonia example (see Chapter 4). Two additional examples are described below to reinforce this important point:

1. Hemiplegia (Code 34290) is a condition marked by decreased strength in the arm, leg, or sometimes face on one side of the body. It is a symptom and a finding on physical examination, but alone it is not a diagnosis. Hemiplegia must be caused by something. In fact, hemiplegia is such a serious condition that physicians generally mount an extensive search for the cause. In the United States, the most important cause by far is cerebrovascular disease (CVD). Much less frequent causes include trauma, brain tumor, infections, and a number of other diagnoses. There are separate DRGs for each of these conditions; in most cases, the patients would be assigned to DRG 14, stroke. However, Code 34290 is placed in DRG 12: Degenerative Nervous System Disorders, along with Alzheimer's Disease, Huntingtons Chorea, amyotrophic lateral sclerosis, hydrocephalus, myasthenia gravis, and a long list of other conditions. In New Jersey, 79 cases and in North Carolina, 279 cases received a principal "diagnosis" of hemiplegia and were assigned to DRG 12. Most of these cases would perhaps be better placed in their etiologic DRG, such as DRG 14, stroke.

2. Orthostatic hypotension (Code 45800) is a condition which as a symptom is marked by dizziness or light-headedness when the patient stands from the recumbent position. As a physical finding, it involves a drop in blood pressure when the patient rises. Orthostatic hypotension alone is generally not a diagnosis; it must be caused by something.[122] Orthostatic hypotension may stem from numerous conditions including blood loss, fluid loss (e.g., severe

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121 This chapter also highlighted a coding practice which could prove exceedingly costly. For example, a patient with chest pain is admitted to the hospital on a "rule out myocardial infarction" protocol. During his hospitalization, he is deemed not to have had an MI, but the physician lists "rule out MI" as the discharge diagnosis. Medical records personnel are required to code a "rule out" condition as if that condition really existed. The patient's ICD code would therefore be myocardial infarction. This is not an uncommon occurrence. See Chapter 6.

122 There is a relatively rare condition known as chronic idiopathic orthostatic hypotension, which is only diagnosed once an extensive search for etiology has failed to unearth a cause. In this case orthostatic hypotension is a diagnosis, but a "diagnosis of exclusion."

> diarrhea), heart failure, drugs, and many other factors. Each of these may have specific etiologies (e.g., bleeding peptic ulcer); this would then be the diagnosis, and the patient would be assigned to a specific DRG on this basis. However, Code 45800 is placed into DRGs 141 and 142: Syncope and Collapse. Syncope and collapse are clinical events (much like cardiac arrest is a clinical event), not a diagnosis. In New Jersey, 187 cases and in North Carolina, 274 cases received a principal "diagnosis" of orthostatic hypotension, and were assigned to DRGs 141 and 142. It would be clinically appropriate to reassign these cases to the DRG pertaining specifically to the cause of their orthostatic hypotension.

This problem of clinically overlapping groups thus appears to be a fairly frequent occurrence in medical DRGs. It is not as much of an issue for surgical DRGs because surgical DRGs are defined by specific procedures. Even for the medical DRGs, this happening would not be a problem if DRGs were all reimbursed alike. However, if DRGs are reimbursed differently, it may often make perfect clinical sense to assign a patient to the most lucrative diagnostic category. For example, suppose the relative weights currently used for hospitals were adopted for physician reimbursement. Under this system, cases assigned to the angina DRG receive lower amounts than cases in the atherosclerosis DRGs. Since most elderly patients with angina also have coronary artery disease, they could all be assigned to the atherosclerosis DRG. This reassignment is totally accurate from the medical perspective. Thus, under a physician DRG program, one may begin to see shifts in caseloads, away from one DRG (e.g., angina) and into others (e.g., atherosclerosis), as physicians pay increasing attention to the listing of discharge diagnoses. These shifts are driven by the problems inherent in using the ICD coding system as a reimbursement tool.

10.4 SEVERITY OF ILLNESS

One of the most cited omissions from the DRG methodology is the absence of a means to accommodate severity of illness. Underlying this concern is the assumption that severity of illness and cost are somehow related. The usual feeling is that the two are positively correlated -- as severity increases, costs rise. As the clinical discussion suggests, this may sometimes be the case. But the severity issue is not straightforward.

First, severity is not a unitary concept that can be measured across diseases. Severity has different meanings (and different cost implications) in different settings. Several examples are as follows:

1. Cerebrovascular Disease. A stroke patient with profound weakness on one entire side of his body who is also unable to speak is more severely ill than a patient with moderate weakness in one arm. A greater portion of the first patient's brain has been compromised and functionally he is more impaired. However, both patients may have identical physician costs: both may receive neurology consultations and both may require a neuroradiologist to read their CT scans.

2. Gastrointestinal Hemorrhage. A patient with intractable acute and massive bleeding from an unknown gastrointestinal source is more severely ill than a patient with a slow, chronic bleed from a benign colonic polyp. The first patient confronts a life-threatening emergency. His costs will be substantially higher as gastroenterologists, surgeons, endoscopers, angiographers, and others are called to evaluate him.

3. Diabetes Mellitus. A brittle diabetic with frequent bouts of diabetic ketoacidosis is more severely ill than the diabetic who rarely suffers diabetic ketoacidosis. However, physician care for a given episode of diabetic ketoacidosis may be identical for these two patients.

Thus, the relationship between physician costs and severity is not always clearcut. The relationship of costs for patients of differing severities may vary depending upon the particular clinical setting and DRG. In addition, one cannot equate severity across diseases -- is the disabled stroke patient as severely ill as the gastrointestinal bleeder or the brittle diabetic in diabetic ketoacidosis?

Second, severity may actually bear a paradoxical relationship to cost. The field of oncology offers the clearest example of this paradox: patients using resources intensively in the earliest stage of illness, with resource use dropping sharply during the terminal phase of care. As discussed in the respiratory neoplasm presentation (Chapter 5), during their very first admission, lung cancer patients may consume tremendous resources. Tumor tissue type is established, metastatic work-up performed, and therapy planned. Patients may be evaluated by surgeons, pulmonologists, oncologists, radiation therapists, radiologists, and others. Subsequent admissions may have a limited focus, such as administration of chemotherapy. This clinical expectation was corroborated by the preliminary analysis on readmission costs (see Section 5.6). Costs for the first lung cancer admission were significantly higher than costs for the second, particularly for consultations and diagnostic surgery.

On the other end of the paradox, terminal care may actually prove less expensive. Once it is believed "there is nothing more to do," cancer patients face a choice as to whether they desire heroic measures to prolong life. Many patients choose only to be kept comfortable (e.g., with adequate pain control) and opt for care outside the intensive care unit. Thus, specialists are no longer required to plan aggressive medical therapy or evaluate tumor spread, and physician costs may be fairly minimal.

Third, severity of illness assessments must incorporate the entire patient. This requires considering the interaction of comorbidities with the primary disease. This may be a very difficult task, especially when one wishes to aggregate patients. For example, how does a pneumonia patient with known prior cardiac arrhythmias compare to a pneumonia patient with diabetes?[123] One may argue that this cardiac disease will have little influence on the course of the pneumonia; the diabetes may tip the patient towards more severe pneumonia. But if the patient had renal failure and a high potassium level, cardiac arrhythmias (on the basis of cardiovascular

123 Both are considered legitimate comorbidities under the DRG system.

disease, not electrolyte imbalance) may be a life-threatening combination. Because of the myriad possible combination of diseases, comparing severities of groups of patients with different comorbidities may be problematic.

The impact of comorbidity -- as defined by the DRG methodology -- on cost is not always as expected. One startling example was the atherosclerosis DRGs, in which physician costs were actually cheaper for the group incorporating older age and comorbidity. The comorbidity issue was explored in greater depth in the pneumonia discussion (Chapter 4). Costs in DRG 89 were higher than costs in DRG 90: by $42 in New Jersey and $9 in North Carolina. But these differences are surprisingly small given that DRG 89 supposedly has the sicker caseload (older patients and those with complications and comorbidities). However, it became apparent that relatively few comorbidities were actually being coded on pneumonia patients. Therefore, these comparisons may not accurately reflect the aggregate impact of comorbidity.

In summary, although the DRG methodology does not specifically consider severity of illness, the effects of adding a severity measure are not readily predictable. There may not always be a perfect positive correlation between severity and cost, and it is difficult to compare severity across diseases and across comorbidity combinations. However, consideration of severity of illness would certainly enhance the acceptability of the DRG system to physicians, and may, in many cases, improve the ability of the system to approximate costs.

10.5 DIAGNOSIS AS A PREDICTOR OF COSTS

One of the premises underlying choice of the four parameters used to guide the clinical analyses was that diagnosis alone is not a powerful predictor of costs. A related suspicion was that severity of illness also is not a reliable predictor of costs, even when combined with diagnosis. Other clinical factors may prove equally important in influencing cost.

The failure of diagnosis to adequately predict costs originates in the vast array of diagnostic and therapeutic options currently available. Costs per diagnosis may have been more homogeneous in the previous era where there was often little that could be done for a patient. Now, however, a stroke patient may not only receive one CT scan, but he may also receive multiple CT scans. If the air contrast barium enema does not reveal the cancer, the patient may then receive a colonoscopy. In addition, new technology is continually developing, generally without clear guidelines directing its early use. For example, how helpful would it be for that stroke patient to receive an NMR study in addition to his CT scan?

This panoply of technology would not present a problem if all doctors practiced alike. But they don't. Styles of practice vary dramatically, from region to region, from hospital to hospital, and from doctor to doctor. This was recognized many years ago by Wennberg, and was recently readdressed by studying admission rates across Maine hospitals. Considerable variation in rates of hospitalization for particular illnesses was found:

> It is likely that much of the variation... is due to differences in physicians' practice styles... one must assume that physicians exercise a great deal of discretion in deciding whether or not to hospitalize patients with gastroenteritis, bronchitis, or simple pneumonia.[124]

However, admitting the patient is only one step. The physician must then choose which test to order and therapy to pursue. At this level, the variability is tremendous.

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124 John E. Wennberg, Klim McPherson, and Philip Caper, "Will Payment Based on Diagnosis-Related Groups Control Hospital Costs?", New England Journal of Medicine 311 (1984): 298.

The last two clinical parameters -- discretionary use of resources and differences in therapeutic approach -- are discussed next in Sections 10.6 and 10.7. A common undercurrent is that in many medical decisions, the "best" option is not always obvious. One of several paths may be chosen, each with different costs and clinical implications. Unfortunately the clinical risk/benefit tradeoff must often be made using imperfect information.

10.6 DISCRETIONARY USE OF RESOURCES

10.6.1 Consultations: Medical DRGs

One of the most common discretionary resources used in the care of medical patients is the consultation. Although it is common, the true scope of the practice and its effect on patient care is poorly understood. In current parlance, the consultation is a purely cognitive service, but a number of studies have suggested that consultations often result in the ordering of more tests and procedures. The impact of consultations on quality of care, patient outcome, the occurrence of complications from additional procedures, and patient satisfaction has not been adequately measured.

Despite this, many medical patients receive consultations. The requirements for consultations may vary across diseases and thus DRGs. For example, it is less likely that a consultant would be needed to help treat a case of simple pneumonia in an otherwise healthy patient. On the other hand, at some point during the care of a cancer patient, it may be necessary to consult an oncologist to aid in planning the best chemotherapeutic regimen. Similarly, in a gastrointestinal hemorrhage case, a consultant may be asked to suggest then perform the procedure with highest expected diagnostic yield.

The types and number of consultants may also vary across diseases and thus DRGs. For example, the major consultants required for a cerebrovascular disease patient include a neurologist and possibly a neurosurgeon and neuroradiologist. However, a lung cancer patient may receive consultations from surgeons, pulmonologists, oncologists, radiologists, and radiation therapists.

The 1982 Medicare data reveal striking differences in consultation rates between New Jersey and North Carolina. In some cases New Jersey rates are two to three times rates in North Carolina. Rates for medical consultations are higher than surgical rates in both states; the differential between New Jersey and North Carolina rates is greater for medical than surgical consultations. When consultation rates for urban and rural settings are examined separately, the discrepancy between New Jersey and North Carolina remains. In both states, urban patients generally have higher consultation rates than rural patients. The urban/rural difference is more pronounced in North Carolina. Even so, the urban North Carolina rate remains below the rural New Jersey rate. For example, in diabetes (DRG 294), 22.2% of rural New Jersey cases and 18.6% of urban North Carolina cases recieved medical consultations.

What can account for these differences between New Jersey and North Carolina? Certainly the discrepancy between the urban and rural rates may be easier to explain. Urban hospitals are more often referral centers where patients come specifically to receive specialized care; these hospitals are generally more densely staffed with the specialists who serve as consultants. However, urban North Carolina rates are even lower than rural New Jersey rates. This suggests differences in statewide practice patterns. Many factors may contribute to these differences: local practice patterns and standards of care; accessibility of specialists and their respective technologies; sophistication and demands of the patient population; level of medicolegal concerns.

Even with the lower rates observed in North Carolina, consultations appear an established part of medical practice. They account for important Part B costs directly and Part A costs indirectly through generating additional use of technology. Their impact on patient care is unclear, but they are part of established accepted medical standards. A prospective payment system for physicians could substantially alter the use of consultations.

10.6.2 Consultations: Surgical DRGs

The issue of consultations is also important for surgical patients. The impact on cost variability may not be as striking as for medical DRGs, because the surgeon's own fee is so proportionately large that it overwhelms that of the marginal medical consultant. But the medical consultation may be critically important to the care of the surgical patient. This is especially true of elderly patients who may have extensive cardiac, pulmonary, or renal disease. A surgeon may request "medical clearance" before taking the patient to the operating room. In some cases extensive medical and surgical collaboration maximizes the chance that a patient will safely endure an operation.

Table 10.1 presents medical consultation rates for selected surgical DRGs. Consultation rates are actually higher than for many medical DRGs. This is particularly true for DRG 209: Major Joint Procedures and may reflect the frailty of many of the patients receiving this service. Rates are higher in New Jersey than North Carolina, but both states demonstrate that the medical consultation is an important part of surgical care. In many cases it may in fact be integral to quality of care.

A related issue involves use of additional operating room personnel such as assistant surgeons. Once again, addition of these personnel may contribute

TABLE 10.1

PERCENT OF CASES RECEIVING MEDICAL CONSULTATIONS:

SURGICAL DRGS

Surgical DRG	New Jersey	North Carolina
DRG 5: Extracranial Vascular Procedures	58.7	37.4
DRG 39: Lens Procedures	40.6	7.1
DRG 110: Major Reconstructive Vascular Procedures	58.7	36.1
DRG 161: Inguinal and Femoral Hernia Procedures	37.8	17.6
DRG 197: Total Cholecystectomy w/o CDE	43.4	19.9
DRG 209: Major Joint Procedures	66.3	42.5
DRG 310: Transurethral Procedures	39.3	18.5

only marginally to the cost variability within DRGs because of the large share of costs comprised by the attending surgeon's fee. But when totalled across patients, these personnel in aggregate may account for substantial Part B costs.

The North Carolina and New Jersey data provide convincing evidence of regional differences and perhaps even surgical specialty differences in use of these resources (see Table 10.2). The magnitude of these differences is most striking in ophthalmologic surgery: 75.6% of New Jersey and 2.2% of North Carolina lens procedure cases used assistant surgeons. In one important instance North Carolina actually appears to use more assistant surgeons than New Jersey -- major joint procedures. Despite these differences, both states appear to use significant numbers of assistant surgeons. They may be part of accepted standards of care for surgical services, but their contribution to

TABLE 10.2

PERCENT OF CASES USING ASSISTANT SURGEONS

Surgical DRG	New Jersey	North Carolina
DRG 5: Extracranial Vascular Procedures	57.3	31.7
DRG 39: Lens Procedures	75.6	2.2
DRG 110: Major Reconstructive Vascular Procedures	61.9	45.4
DRG 161: Inguinal and Femoral Hernia Procedures	42.9	17.0
DRG 197: Total Cholecystectomy w/o CDE	61.0	47.9
DRG 209: Major Joint Procedures	51.4	56.6
DRG 310: Transurethral Procedures	1.4	7.4

quality of care and patient outcome is similarly unknown. Their use may be decreased, however, under a prospective payment system.

10.6.3 Technologies

Significant Part B costs are also incurred in the use of procedures and diagnostic technologies. For example, a cardiologist (or radiologist, depending on institutional practices) must always perform the cardiac catheterization; a gastroenterologist must guide the colonscope. Variable use of these resources in identical patients is the norm rather than the exception -- practice styles vary widely, regionally, institutionally, and even within institutions. This varying use of technology could have substantial cost implications.

This issue was explored using the 1982 Medicare data in Chapter 7 on gastrointestinal hemorrhage. Both New Jersey and North Carolina patients obtain large numbers of tests; about half of the patients in both states obtain two or more services. However, in New Jersey, patients with fewer services were most likely to have endoscopy, whereas in North Carolina, patients with fewer services were most likely to have a radiologic exam. Once patients had three or more tests, the pattern began to even out, with New Jersey and North Carolina showing similar proportions of radiologic and endoscopic services. This study demonstrated the variability both within states and between states in the use of diagnostic technologies.

What is the differential benefit of different technology use patterns? Although a few comparative studies have been performed (e.g., comparing the diagnostic effectiveness of barium enemas with colonoscopies), they are fairly limited. The effects of modifying use of these technologies by establishing fixed reimbursement levels is not at all predictable.

10.7 DIFFERENCES IN THERAPEUTIC APPROACH

Absolute consensus on treatment is a rarity. For example, all physicians would agree that an infected, inflamed appendix should be surgically removed. Similarly, all physicians would agree that insulin must be administered to Type I diabetics, but a considerable range of opinion remains as to amount and timing of doses. However, for most treatment decisions, practice patterns may vary. Several factors may contribute to this variability:

1. Imperfect Information. Despite the many technologic advances made in the field of medicine, much remains unknown. This is true both at an aggregate level (e.g., how one treatment compares to another) and at the individual level (how a particular patient will respond to a given intervention).

2. Individual Clinical Judgement. Because decisions must be made in spite of imperfect information, physicians often rely on individual "clinical judgement." This intangible attribute originates in each physician's training and experience, and thus is a unique constellation for each individual.

3. Different Goals of Therapy. Different therapeutic objectives may pertain to different patients with identical medical conditions. One goal may be to cure disease using a hazardous and largely untested therapy. Another goal may be to control disease using a safer common approach which will abate but not eradicate disease.

4. Patient Preference. Individual patients may vary concerning the approach with which they wish to treat their disease. They may choose a physician whose goals are consistent with their own preferences.

Thus, this issue of differences in therapeutic approach originates from a number of factors pertaining to the state of medical knowledge as well as to individual physicians and patients. As demonstrated in the clinical analyses, different therapeutic approaches may generate substantially different costs. Summaries of several examples are as follows:

1. Cerebrovascular Disease. Several therapeutic controversies remain in the treatment of stroke patients. Should patients with blocked arteries receive surgery? When should this surgery be performed? Should patients with embolic strokes be anticoagulated with warfarin (necessitating an extra week in the hospital)? Or should they be placed on aspirin and Persantine, and discharged once stable? The literature abounds with controversial information on these options. Each has obvious resource implications (see Chapter 3).

2. Respiratory Neoplasms. Mesothelioma (tumor of the lung covering caused by asbestos) is an incurable disease. Because it is so deadly, many chemotherapeutic agents have been used to combat it, none with much success. Adriamycin has shown the most promise, but even its success is very limited. In addition, adriamycin is cardiotoxic; it often leads to heart failure. Thus, patients and physicians confront a choice: either they can do nothing and administer only palliative therapy during the terminal phases of the illness; or they can attempt chemotherapy with known dangerous side effects and chance only at tumor control, not cure. These two options entail very different costs (see Chapter 5).

3. Diabetes Mellitus. Diabetes is a disease in which patients often take a very active role in directing the course of therapy. This is due to the nature of the primary therapy for the disease (insulin injections which the patients often self-administer). Patient attitudes may significantly affect the course of hospitalization. Some patients may be highly motivated to control their disease, learn quickly, and have comparatively short hospitalizations. Other patients may misunderstand or not care as fervently about control of their diabetes. They may eat candy in the middle of the afternoon or refuse their 10:00 p.m. snack. These patients may require longer stays and more intensive physician intervention (see Chapter 8).

Thus, considerable variability may arise from differences in therapeutic approach. The root of this variability may be outside the realm of control by reimbursement policies directed soley toward physicians -- inadequate medical knowledge, different therapeutic goals, patient preferences. Yet these factors may have important implications both for quality of care and quality of life of patients.

10.8 IMPLICATIONS OF THE PROSPECTIVE PAYMENT SYSTEM FOR PHYSICIAN BEHAVIOR

Each of the seven clinical examples concludes by speculating about physician behavior under a DRG system for that particular diagnosis. This section synthesizes these speculations. Underlying these projections is the assumption only that fees will be fixed separately for each DRG, and that all physicians on a case must share these fees. The important question of how these fees will be distributed is left unanswered.

10.8.1 "DRG Creep"

The term "DRG Creep" has come to enjoy generic usage signifying manipulation of diagnosis to maximize reimbursement. It was coined by Simborg in 1981 reporting on diagnostic manipulations under the original 383-DRG system: "Minor diagnostic nuances and slight imprecisions of wording have little practical clinical importance, yet under DRG reimbursement they would have major financial consequences."[125] The most overt method of creep he cited was the use of a computer algorithm to identify the most lucrative of of several potential principal diagnoses. He termed this particular practice "blatantly unethical."[126] However, as demonstrated in the clinical discussion, there may be several forms of DRG creep, some of which are inherent in the ICD system itself. The bases of several types of creep are listed below:

1. Vagaries of the ICD System. The ICD system intermingles levels of diagnoses (e.g., symptom, clinical diagnosis, pathologic event, clinical event), yielding overlapping clinical groups. The DRG

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125 Donald W. Simborg, "DRG Creep: A New Hospital-Acquired Disease," New England Journal of Medicine 304 (1981): 1604.

126 Ibid., p. 1603.

methodology incorporates this practice, also producing groups which may not be mutually exclusive from the clinical perspective (see Section 10.3). Therefore, placing a particular patient into any of the related groups may be perfectly medically accurate.

2. Cause and Effect Comorbidities. Many conditions qualify as acceptable comorbidities under the current hospital DRG system. From a clinical perspective it is sometimes difficult to determine which should be listed as the principal diagnosis when comorbidities bear a cause and effect relationship. For example, a patient enters the hospital because of seizures. The seizures are caused by lung cancer metastatic to the brain. Which should be the principal diagnosis: "Seizures" or "Metastatic Lung Cancer"? A single diagnostic phrase ("seizures secondary to metastatic lung cancer") accurately captures the clinical situation, but cannot be translated into a single ICD code. Either choice would be legitimate and could not be construed as "unethical."

3. Unrelated Comorbidities. A more problematic situation involves unrelated or only potentially related comorbidities. For example, a patient being treated for pneumonia also has frequent kidney stones despite adequate hydration. The two are probably unrelated, and it would be difficult to justify listing the kidney stones as the principal diagnosis. However, what if the relationship between the comorbidities was not clearcut? For example, the pneumonia patient also has diabetes. One could argue that the diabetes predisposes the patient to pneumonia, particularly severe pneumonia. But is this adequate justification for listing diabetes as the principal diagnosis?

4. Coding Practices. In this case, DRG creep is abetted by coding requirements:

> If the diagnosis at the time of discharge is stated as "suspected," "questionable," "likely," "?," and so forth, code the condition as if it existed or was established.
>
> If the discharge diagnosis is stated as "rule out...," it is to be interpreted as "suspected."[127]

"There are legitimate medical vagaries and uncertainties in many diagnostic situations. When does abdominal pain and duodenal scarring on an upper-gastrointestinal tract series become the more costly 'probable duodenal ulcer'?"[128] In numerous instances, "probable" diagnoses could be transformed into "actual" diagnoses merely because of coding conventions.

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127 ICD-9-CM Coding Handbook for Entry-Level Coders, Chicago: American Hospital Association, 1979, p. 58.

128 Simborg, p. 1604.

Under physician DRGs, the incentive for DRG creep would be heightened; the benefits of the practice would have direct impact upon physicians. The first two types of creep are medically legitimate and would be difficult to monitor. Even in the last two types, where the pecuniary motivation may be more overt, certain cases may be clinically reasonable. Thus, although the term "DRG creep" has a pejorative connotation, its impetus may be inherent in the DRG design.

10.8.2 <u>Pursuit of Diagnosis</u>

Many of the DRGs are defined not as diagnoses but as symptoms -- gastrointestinal hemorrhage, chest pain, syncope and collapse, for example. Obtaining a specific diagnosis may often prove very costly. For example, to spot the colon cancer causing the gastrointestinal blood loss may necessitate a barium enema and a colonoscopy. Each test has a concomitant physician cost which the attending physician may be loath to share. How might a physician DRG system affect the fervor with which physicians pursue diagnosis? Several possibilities are as follows:

1. <u>Increased Pursuit</u>. In certain cases, the marginal gain from a specific diagnostic test may exceed the marginal cost of the test. "...The increased yield of expensive and more sensitive diagnostic studies [may] more than pay for themselves if they shifted the DRG."[129] For example, finding the exact etiology of the infection may allow reassignment of the pneumonia patient to a more lucrative DRG. This may be worth the cost of a consultant performing a transtracheal aspiration.

2. <u>Lessened Pursuit</u>. In cases where DRG assignment would not be altered, it may not be worth the cost of diagnostic work-up to specify the exact etiology. Physicians would then prescribe empirical therapy based upon the best guess of the cause of the patient's problem. For example, they would empirically treat the anemia patient with iron supplements or the pneumonia patient with penicillin. If these treatments fail, either another treatment could be tried or exact diagnosis pursued.

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129 Ibid.

Thus, the impact of a DRG system on pursuit of diagnosis may vary with the consequences. However, it is important to remember that diagnosis is usually not an end in itself; it is usually only helpful if it results in improved therapy. If indeed more empiric therapy becomes standard practice, the impact on patient care, outcome, and costs is impossible to predict.

10.8.3 Consultations

One physician resource used in pursuit of diagnosis and therapeutic planning is the consultation. If attending physicians must share their fees with consultants, they may think twice before ordering this service. However, it is unlikely that the consultation practice will vanish. In many cases, under a DRG system, a consultant may actually help the attending save money. Two possible scenarios are as follows:

1. Consultants save money. Because of their specialized knowledge, consultants may be more confident of diagnoses with less technologic evidence or may be able to suggest the most cost-effective approach to a problem. For example, a neurologist may save the cost of a neuroradiologist by substituting his physical exam skills for a CT scan. An oncologist may feel so certain that a particular bone finding represents metastatic disease that he may save the cost of a bone biopsy. In these types of substitutions, a specialist may be called earlier in the patient's hospitalization than previously. The hope may be that the specialist may help speed up the course of care.

2. Consultants cost money. Consultants may in certain cases add only marginally to the knowledge of a generalist. For example, an attending may choose to treat a simple pneumonia case himself rather than call in an infectious disease consultant. In addition, consultants may suggest expensive tests which the general physician then feels compelled to order.

The most likely outcome of a DRG reimbursement system is that fewer consultations will be ordered. Where possible, consultations may be obtained outside the hospital setting. Certainly in instances where specialists contribute only marginally to patient care, decreasing consultations may be a positive change. But there are equally certainly circumstances where consultants provide an important service. Striking the proper balance is difficult in light of the poorly understood role of the consultant in quality of care and patient outcome.

10.8.4 Split Admissions

The practice of splitting admissions involves creating two admissions where formerly there may have been only one. A physician DRG system may encourage this practice: two DRG fees are better than one, especially when that one must be shared with another physician. Presumably the PROs may monitor admission patterns to discourage splitting admissions. But in some cases splitting may be medically defensible. Several different types of split admission combinations are as follows:

1. Medical/Surgical Splits. The most obvious impetus for splitting admissions would arise when a surgeon and general medical doctor must share fees. If a patient is admitted for a medical condition which may also be treated surgically, both physicians could claim their full fee if admissions were split. In some cases it is clearly unethical to send the patient home before surgery (see Section 10.8.5). But in other cases it is controversial. Debate continues as to whether it is best to surgically open blocked cerebral arteries directly after a stroke or weeks later. Settling this controversy by reimbursement policies may have long-term impact on patient care, but it is difficult to predict the exact outcome.

2. Medical/Medical Splits. DRG reimbursement may generate practices which in effect become splitting one medical admission into two. In many diagnoses, it is difficult to know the exact endpoint of care. When does one discharge the patient in sickle cell crisis or congestive heart failure? It is generally believed that a prolonged admission for heart failure in which fluid imbalances are meticulously corrected may result in a longer period of freedom from failure. Some physicians have adopted this practice. Others admit their patients for frequent, short stays, and only address the most pressing problems. This latter practice may become the norm under a DRG system.

   In some cases, medical/medical (or medical/surgical) splits may be good. For example, in many institutions there are long waiting lists for such procedures as cardiac catheterization. To advance on the queue a patient must remain hospitalized. If hospital policies changed to allow stable patients to remain on the waiting list while at home, this may result in a cost saving.

3. Incidental Findings. Many hospitalizations unearth findings which do not relate specifically to the reason for admission. For example, a pneumonia patient is found to be anemic and have a trace of blood in

his stool. Should the incidental finding be worked up by prolonging the pneumonia admission, or should the patient go home, rest and recover fully for the pneumonia, then be readmitted for the evaluation of anemia?

10.8.5 Earlier Triage to Surgery

Certain disorders are first approached medically; if that fails, surgery is the next resort. In cases where it would be unsafe and unethical to release the patient prior to adequate resolution of the problem, physicians may opt for surgery sooner under DRG-based reimbursement. For example, a patient with a bleeding peptic ulcer may first be treated with antacids. If he continues to bleed, the patient would receive surgery. Since the possibility of surgery is omnipresent, the medical doctor may allow the antacid therapy only a few days to work. He must then share his fee with the surgeon, but he will have provided fewer days of care to the patient. The impact on overall costs of this practice cannot be assessed (the patient may have improved on antacids given a few extra days, surgery may produce complications, and so on).

10.8.6 Case Mix

Although it is not always possible to predict on an individual basis, certain classes of patients may be more expensive to treat than others. For example, the impoverished elderly or patients with histories of malignancy, diabetes, or alcoholism may present with more complicated disease, requiring more consultants and longer hospitalizations. Conversely, other patients may present opportunities for low cost admissions (e.g., the newly-diagnosed diabetic may be hospitalized for insulin teaching). Manipulating the case mix of patients may become an incentive for physicians under a DRG-based reimbursement system. However, the practice of avoiding high cost patients may in fact be fairly limited if there is a local oversupply of physicians. Due to competitive pressures, physicians may find it necessary to accept patients from the risky groups. They may try to compensate for these losses by admitting other patients with minimal indications. The role of the PRO may be critical in controlling inappropriate admissions.

10.8.7 Transfers

Closely related to the case mix issue is the transfer of patients. The tertiary care referral center is the citadel of American medicine. Complicated cases are transferred to these centers to receive the maximum attention of specialists and technology. Under a DRG system, community physicians may have a lower threshhold for transferring their patients to these institutions and to specialists at these centers. Community physicians may prefer not to take the financial risks encumbent upon caring for a critically ill or extremely complicated patient. By default, therefore, the new attending physician specialist may be placed at considerable risk. First, patients will be sicker.[130] Second, patients and referring physicians expect a certain standard of care from these institutions. They anticipate a flurry of consultations and evaluative procedures. The specialist attending must balance these demands against his need for future referrals and cost issues.

10.8.8 Setting of Care

To the extent possible, attending physicians may attempt to defer as many services as possible to an outpatient setting (this currently remains under fee-for-service reimbursement). For example, a patient may be stabilized and immediately-necessary therapy instituted during the hospitalization. The patient may then be discharged to receive his specialist consultations and diagnostic procedures in an ambulatory unit. In this manner, specialists will continue to bill separately for each service, and the attending would minimize the sharing of his DRG fee.

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130 It is possible that as the number of community-based specialists grows, and as competition for patients increases, only sicker and sicker patients will be transferred to tertiary care centers.

10.8.9 Choice of Therapy

As described in Section 10.7, considerable controversy remains in the therapy of many medical diseases. Information surrounding different regimens may be incomplete or even contradictory. However, different therapeutic options may entail different costs. If a DRG payment is set in the middle, between the most expensive and the cheapest option, what would be the incentive to choose the more expensive option? What if the clinician sincerely believed that the more expensive treatment was best for his patient? What if the available medical evidence suggests that the more expensive therapy may actually be slightly better? Over the longer term, an additional concern may arise. If only the cheaper option is used, adequate comparison between the two may never take place. The superiority of one treatment over the other may never be established. What if properly-conducted trials actually showed that the more expensive treatment would have been better? Is this an acceptable outcome?

10.9 IMPLICATIONS OF THE PROSPECTIVE PAYMENT SYSTEM FOR PATIENT CARE

The implications of the prospective payment system for physician behavior outlined in Section 10.8 bear a striking resemblance to many of the adjustments hospitals were expected to make under the DRG system -- "DRG creep," splitting admissions, manipulating case mix, shifting care to the fee-for-service outpatient sector. However, there is an important difference between doctors and hospitals. One portion of this difference has been repeatedly emphasized throughout the clinical examples: DRGs are an epidemiologic construct; their impact was designed to average out across large numbers. While hospitals deal in large numbers, individual physicians do not. Their caseload of hospitalized Medicare patients may be exceedingly small. Because per case losses and gains may not cancel out in a tiny caseload, individual physicians may confront important risks.

However, the difference between hospitals and physicians is not limited to discrepancies in their caseloads. The differences are much more fundamental and obvious, rooted in the discrepant motivations of institutions versus individuals. Maximizing income may be only one of many goals motivating a physician; in many instances, aggrandizing income may not in fact be the physician's primary objective. An individual physician's primary motivation may be an intangible ethical and moral obligation to do what is "best" for the patient, regardless of its implications for the success of other goals. This may actually be perceived by some as a duty, not as a goal which physicians may pursue with varying degrees of vigor:

> ...Physicians are required to do everything that they believe may benefit each patient without regard to costs or other societal considerations... When practicing medicine, doctors cannot serve two masters. It is to the advantage both of our society and of the individuals it comprises that physicians retain their historic single-mindedness. The doctor's master must be the patient.[131]

Beyond this ethical imperative, are a number of other goals which may also supercede income maximization. Peer recognition, the intellectual challenge of practice in an academic teaching center or basic science research may steer physicians into work settings which are less lucrative than community-based practice. Physicians may also practice "defensively," to avoid the stigma and losses of lawsuits. A final motivation is of recent vintage, arising from concern about the enormity of societal health care costs. That new objective stipulates that physicians make patient care choices while considering society's need to control expenditures -- in essence to "protect the medical commons."[132]

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131 Norman G. Levinsky, "The Doctor's Master," New England Journal of Medicine 311 (1984): 1573-1575.

132 Howard H. Hiatt, "Protecting the Medical Commons: Who Is Responsible?" New England Journal of Medicine 293 (1975): 235-241.

A DRG-based reimbursement system places the physician directly in this "protector" role. Depending on how the system is structured, many decisions a physician makes to enhance patient care could detract from his own income or the income of his colleagues. Although this trade-off may be softened by modifying the actual reimbursement methodology, the physician remains in the uncomfortable position of making choices contradictory to that intangible goal of providing the best possible care. This schizoid nature in their objectives may present an irreconcilable dilemma:

> ...The pressure to be more economical in the provision of care will force physicians to make decisions that are contrary to the best interests of individual patients, even though these decisions may make a great deal of sense from the viewpoint of society as a whole... For physicians to have to face these trade-offs explicitly every day is to assign to them an unreasonable and undesirable burden.[133]

Thus, the implications of the prospective payment system for physician behavior are not as straightforward as stated in Section 10.8. Those implications assumed a simple desire to maximize income, to avoid sharing fees with colleagues when possible. But the motivations are much more complex. Even if an individual physician is assumed to have a consistent set of goals, he may exercise those goals slightly differently for each patient due to individual patient objectives. For example, if the patient is overtly litigious, a physician may order more tests than he ordinarily would. In any case, the most important question is not how physicians' behavior will change, but how will these changes affect patient care?

The seven clinical examples suggest several possible dilemmas which may confront physicians[134]:

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133 Victor R. Fuchs, "The 'Rationing' of Medical Care," New England Journal of Medicine 311 (1984): 1572-1573.

134 These dilemmas also influence Part A costs, but the decisions must be made by the physician, not the hospital.

1. <u>Cerebrovascular Disease</u>. Should the embolic stroke patient receive the more expensive warfarin anticoagulation or the cheaper aspirin and Persantine? Should the stroke patient with blocked arteries receive surgery immediately or should he wait three weeks? Should he receive surgery at all?

2. <u>Pneumonia</u>. Should the patient who is having increasing difficulty breathing be placed in the ICU now where he can be closely watched? Or should he wait until intubation is definitely required and risk emergent intubation on the general medical floor?

3. <u>Respiratory Neoplasm</u>. In the patient who has failed conventional therapy, should an expensive experimental therapy with unproven risks and benefits be tried? Or should he be palliated with only minimal intervention?

4. <u>Atherosclerosis</u>. Should the "rule out myocardial infarction" patient automatically enter the coronary intensive care unit? Or can he be managed on the general medical floor?

5. <u>Gastrointestinal Hemorrhage</u>. Should multiple tests and therapies be serially pursued if the first ones fail? Should a patient be triaged early to surgery, giving medical management only a limited chance for success?

6. <u>Diabetes Mellitus</u>. Should an aggressive and costly evaluative and therapeutic posture be adopted because the patient wants it, despite the more conservative options available?

7. <u>Red Blood Cell Disorders</u>. Should empirical therapy be instigated on a "best guess"? Or should exact diagnosis be vigorously pursued prior to treatment?

Each of these dilemmas does not have a single resolution. Approaches towards settling the questions may vary depending on the goals one wishes to fulfill. In none of these potential answers is it perfectly obvious how quality of care and outcome will be affected -- only that it <u>will</u> be affected.

However, it is clear that a DRG-based physician reimbursement system will affect numerous aspects of medicine -- physician attitudes, patient/physician relationships, technology introduction and review, malpractice litigation, medical knowledge, and possibly quality of care. Yet, many agree that it is inappropriate to place the responsibility for controlling health care costs in the hands of an individual physician caring for an identified patient:

> ...It is surely not fair to ask the physician or other medical-care provider to set [national priorities] in the context of his or her own medical practice. A physician or other provider must do all that is permitted on behalf of his patient... The patient and the physician want no less, and society should settle for no less.[135]

Resolving this important issue is a major task in the design of the prospective reimbursement system.

10.10 RECOMMENDATIONS FOR FURTHER STUDY

10.10.1 ICD-10

10.10.1.1 Nomenclature

Work is underway on the latest version of the *International Classification of Diseases* (ICD-10). In parallel to this international undertaking, it is desirable to develop an American version designed specifically for DRG reimbursement purposes; the DRGs should then be reformulated to fit the ICD-10 nomenclature. This pursuit should focus on eliminating the equating of different "levels" of diagnosis which results in clinically overlapping groups. This overlap sets the stage for medically appropriate "DRG creep." Examples of the equating of different "levels" of diagnosis are as follows:

> Patient A has coronary atherosclerosis (pathologic process) resulting in angina pectoris (clinical diagnosis) manifest as chest pain (symptom). Each of these three "levels" of diagnosis directs the patient into a different DRG.
>
> Patient B has pneumonia (clinical diagnosis) resulting in respiratory failure (clinical event). These two "levels" of diagnosis direct the patient into different DRGs.
>
> Patient C has a stroke (clinical diagnosis) resulting in hemiplegia (symptom and physical finding). These two "levels" of diagnosis direct the patient into different DRGs.

One solution may be to stipulate that a clinical diagnosis must always be coded and is the only acceptable level of diagnosis for reimbursement. ICD-10 could be redesigned to relate all pathologic process and symptom codes to

135 Hiatt, p. 239.

clinical diagnoses.[136] Physicians may list pathologic processes and symptoms on the discharge summary, but they must always follow an acceptable clinical diagnosis. If the cause of a symptom has not been precisely identified at the time of discharge, the physician's best "working diagnosis" should be listed. It may be prudent to steer clear of pathologic processes (e.g., coronary atherosclerosis) as reimbursable diagnoses. If reimbursement levels are higher for pathologic processes, it may encourage extra diagnostic tests (e.g., cardiac catheterization in order to obtain the pathologic diagnosis) in settings where a clinical diagnosis is medically reasonable.

10.10.1.2 Coding Rules

Medical records coding rules should be systematically reviewed to identify practices which may encourage manipulation of diagnosis. One prominent example involves the coding of "rule out" conditions as if the condition actually existed. Listing a "rule out" condition on the discharge summary may either represent inattention or a genuine inability to identify the diagnosis. In most cases the object of the admission is to perform the tests required to establish whether or not the condition exists. For example, before a patient leaves the hospital, it is generally known whether or not a heart attack occurred. If it has, "myocardial infarction" would be the diagnosis; if it has not, "angina" may be the diagnosis. In the latter case, "Rule out myocardial infarction" should be an unacceptable diagnosis.

10.10.2 Coding Styles and Data Quality

The clinical analyses reveal that New Jersey and North Carolina appear to practice different coding styles; quality of data also appears to vary. For example, patients in New Jersey with coronary artery disease are more likely

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136 Pathologic process and symptom codes may relate to more than one clinical diagnosis. For example, hemiplegia could relate to stroke and brain tumor.

to receive a clinical diagnosis of angina whereas North Carolina patients are more likely to receive a pathologic diagnosis of atherosclerosis. In this case, different coding styles affect DRG assignment and thus costs. Because of this impact, this issue of regional differences in coding should be studied in detail.

10.10.3 Modifying Hospital DRGs

It may be possible to slightly modify the hospital DRGs to make them a more equitable basis for physician reimbursement and to minimize the potential for DRG creep. Each set of medical DRGs must be examined systematically to identify potential modifications. Each may be reviewed clinically and potential changes tested using the Medicare data.

Several suggestions arise from the preliminary analyses presented in this report. For example, DRGs which combine multiple clinical entities with different physician costs may be split into two or more subgroups both along clinical and cost lines. The subgroups should have significantly different mean Part B costs. This report contains examples of such splits for diabetes (Chapter 8) and red blood cell disorders (Chapter 9). In addition, DRGs which contain overlapping clinical entities on the basis of inconsistent levels of diagnoses could be refined or combined. For example, combining angina (DRG 140) and chest pain (DRG 143) could eliminate this one opportunity for DRG creep. Finally, DRGs which were separated by comorbidity and age for hospital reimbursement may not require such delineation for physician reimbursement. For example, DRGs 89 and 90 could be united, thus thwarting this creep opportunity.

All these possibilities must be further explored. A systematic review of the medical DRGs should be undertaken to identify potential modifications of the DRGs for physician reimbursement.

10.10.4 Severity of Illness

Adding a measure of severity of illness may prove a helpful refinement. However, it is clinically unreasonable to expect that one can meaningfully compare severity across diagnoses. Rather it should be used only to compare severity within diagnosis. The oncologic DRGs may be a place to test out the value of adding a severity adjustment: the information upon which a severity measure may be based (e.g., extent of metastases and other organ failure) is often clinically available and may be coded. Work is already underway through HCFA to incorporate extant computerized case mix and severity measures into the DRG rubric (e.g., Staging from Systemetrics, Patient Management Categories from Blue Cross of Western Pennsylvania). This work should proceed from both a clinical and empirical perspective.

10.10.5 Consultations

The use of consultants is an important clinical practice, but the extent of its use and the implications for cost and patient care are poorly understood. North Carolina and New Jersey vary dramatically in their use of this service. Yet a DRG-based physician reimbursement system may substantially alter use of this service. Should the reimbursement norm accommodate these regional variations? A preliminary overview of the scope of consultation services and its cost implications would be helpful, using a more detailed analysis of the Medicare data. Such a study would provide additional insight into the impact DRG-based reimbursement may have on physician collegial relationships and patient care.

10.10.6 Technology

The Medicare data also suggest that there are substantial regional variations in the use of diagnostic technologies. Costs also vary. This was most clearly demonstrated in the gastrointestinal hemorrhage analysis (New

Jersey patients were more likely to receive endoscopy whereas North Carolina patients were more likely to receive radiologic services). Further analysis of the Medicare data could elucidate these important regional differences and even highlight differences within hospitals and between physicians. Such study may suggest the effect a physician PPS may have upon the use of technology and its potential impact on patient care.

10.10.7 Who to Pay

One important issue was not addressed in this report: who should be paid the DRG lump sum, and how should it be distributed? For physicians, this may be one of the most important factors governing the acceptability of the PPS. It may therefore become crucial to establish the feasibility of different payment options. This is an exceedingly difficult area which deserves further study. An excellent conceptual overview of the options appears in Chapter 2 of the report by Mitchell *et al.*[137] However, the only way in which the practical implications of these options can be tested is by a demonstration project using a range of methodologies.

10.10.8 Quality of Care

Until the physician PPS is actually implemented, one cannot speculate with certainty about how patient care will be affected -- only that it will be affected. One of the primary goals of the system is to change the way physicians behave, to make them more cost conscious. The anticipated outcome is fewer inpatient consultations, diagnostic procedures, and costly technologic interventions. The winnowing out of inappropriate, unnecessary, and marginal services is clearly desirable. But a more important issue is not the impact on patient care alone but how those changes may affect the quality of care. Will

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137 Janet B. Mitchell *et al.*, *Creating DRG-Based Physician Reimbursement Schemes: A Conceptual and Empirical Analysis*, HCFA Grant No. 18-P-98387/1-01, October, 1984.

too few consultations be ordered? Will fewer diagnostic tests reduce complications? Will earlier triage to surgery increase patient risks? Will earlier discharges result in increased recrudescence of incompletely treated disease? These types of issues may be best addressed in a limited trial of the physician prospective payment system in a demonstration setting.